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CONSOLIDATING THE BUSINESS OF GAS SUPPLY IN NEW YORK CITY.

For some time back it has been matter of common rumor that negotiations were being carried on between representatives of the seven gas companies now actually engaged in the business of supplying illuminating gas to the people of New York city, and that these negotiations had for their ultimate object the consummation of a plan of consolidation whereby the different corporations would become merged into one vast manufacturing interest. As is usual in such cases, the greatest possible care was taken to prevent the "leaking out" of any information that would tend to throw light on the topic during the progress of the initial stages of the scheme; and, as a consequence, an immense amount of guess work was indulged in on the part of those known as outsiders. It would be idle at this time to recount any one or more of the wonderful surmises put forward as gospel truth by speculators in gas stocks anent the basis on which the consolidation was to be effected, and this portion of the question may be briefly dismissed with the statement that beyond the mere fact that such negotiations were actually in progress, only the parties engaged in them knew anything of their real import. Even at this time it cannot be considered that the consolidation scheme is absolutely certain of accomplishment, since the details must be submitted to the stockholders, who, by their votes, may either accept or reject the conditions sought to be imposed. However, it is measurably certain that the consent of the shareholders will be obtained at the meetings, which are to be held in the early part of next month, of the stockholders of the various companies.

We have not been enabled to obtain at first hand the details of the arrangement which it is proposed to effect, and are obliged to rely upon what has been published in the daily papers of the city in attempting to outline the matter, although we have assurance from one high in authority that the account given by the New York *Daily Tribune* is substantially correct in so far as concerns the disposition and allotment of capital amounts. The terms of the act of the Legislature under which the scheme may be legally carried out, passed in May, 1884, authorizes or permits the directors of corporations desirous of amalgamating their interests, to enter into an "agreement specifying the terms and conditions of consolidation, and the particular mode or means of carrying the same into effect." Pursuant to these provisions the representatives of the New York, Manhattan, Metropolitan, New York Mutual, Municipal, Knickerbocker and Harlem Gas Light Companies submitted to their several boards of direction a plan in consonance with the laws of the State, and the plan was agreed to. The next step was to submit the particulars of the agreement to the stockholders, the law requiring that shareholders shall have at least thirty days' notice befcre they shall be required to meet and vote upon the measure. In order to secure a favorable affirmation from the shareholders, two-thirds of the entire amount of stock in each company must be recorded as agreeing to the specified provisions. Those voting in the negative are protected in their right of withdrawal, since they may apply to the Supreme Court for relief; should such application be made to that body, the Court will appoint commissioners to appraise the value of the stock held by applicant, and the value of stock as appraised must be paid to the petitioner out of the treasury of the consolidated company. These stockholders' meetings will in all probability be held on or about November fifth.

The act limits the number of trustees in corporations formed under its

provisions to 13, and fixes the duration of corporate existence at not to exceed fifty years. For the first year the board of trustees is to consist of persons named in the agreement under which it was proposed to effect consolidation; and, of course, where everything pertaining to the measure is so vaguely understood as is at present the case, the persons comprising the board of trustees for the first year cannot now be named with any degree of certainty. It is generally believed, however, that the following gentlemen will figure rather prominently in its composition: Gen. Chas. Roome, and Messrs. James W. Smith, Percy R. Pyne, Henry Day, Oscar Zollikoffer, Chas. G. Francklyn, Thos. Rutter, and John P. Kennedy. It will be the duty of the board of trustees, when the stockholders have given the required consent, to choose the officers of the new corporation, organize the business, etc. The *Tribune* explains, "the law prescribes that all debts and obligations of every sort of the combining companies shall be assumed by the new corporation, and that in any suit against any one of the combining companies the name of the new corporation may be substituted for that of the original defendant. The capital stock of the consolidated company will be in the neighborhood of $45,000,000, apportioned as follows:

Name of Company.	Capital Stock.
New York	$7,821,000
Manhattan	12,352,000
Metropolitan	7,422,000
New York Mutual	5,922,000
Municipal	5,276,000
Knickerbocker	3,104,000
Harlem	3,103,000
Total	$45,000,000

"Companies having a bonded or other indebtedness forming a lien on their property, are at liberty to pay off these obligations at the time of consolidation. If, however, they do not do so, the new company will, in the the distribution of its capital stock, retain from the shareholders of each company a sufficient quantity of the new stock to pay off all debts and incumbrances.

"In case the stockholders of any one or more of the companies above enumerated fail to ratify the agreement which has been entered into by the directors, that company or companies will be omitted in the consolidation; and the capital of the new corporation will be diminished by the sum at which the capital of the non-assenting company is valued."

Beyond these mere facts it is impossible to go at the present time, and we must await with patience the result of the November meetings. It will be perceived from what is above published that no reference whatever is made to the Equitable Company, and that it is, so to speak, "left out in the cold." Of course, it is very generally understood that a decided reduction is to be made in the selling prices of gas—some estimates placing that reduction at 50 cents per thousand, while others fix it at 75 cents. The Equitable Company is bound by its charter not to charge over $1.75, and the first-named estimate would only bring the rate of the proposed consolidated company down to an even figure with that of its rival. But all such details will soon be made clear.

The capitalization basis on which the consolidation is founded is, to say the least, a rather wonderful one. How can the originators of the scheme defend their action in regard to the Knickerbocker Company, and why should they allot it, in the division, as within one thousand dollars of the Harlem Company? It has been quite generally understood that the Knickerbocker and Municipal Companies are really one and the same thing, and if this consideration be within the pale of fact, the Municipal shareholders can have but little cause for complaint. The Manhattan Company's allotment of $12,352,000 appears to be about the fairest item in the whole schedule, since should the real estate owned by that corporation to-day be put up for sale under the hammer, it would easily bring two-thirds of that sum. Still until the stockholders have signified their intention in the matter, it is just as well to "watch and wait" before attempting to say anything further regarding the measures involved.

DEFEAT OF THE BOSTON (MASS.) OPPOSITION SCHEME.

In the "Item" columns of our issue for September 16th last we gave an account of the action taken by the Committee on Paving, of the Boston (Mass) Board of Aldermen, in relation to the petition of the promoters of the Consumers' Gas Company, who wished most ardently to foist an opposition gas plant upon the people of the "Hub." From that account it will be remembered a majority of the Paving Committee reported back to the Board that the petitioners have "leave to withdraw," or, in other words, that the prayer of the petitioners be denied. A minority report was also submitted which recommended that the asked-for consent be granted. Under the rules of the Board both reports were laid over for future consideration, and it was not until date of Monday, Sept. 29th, that the question was finally disposed of. The tactics which delayed the adjustment of the matter emanated from the petitioners, who, thoroughly alive to the cogency of the arguments presented by the signers of the majority report, wished to allow as great a period of time as possible to elapse in order that the sharpness of such cogency might thereby become somewhat dulled. But in this they reckoned without their host, for facts are stubborn things, and very stubborn in this case did they prove to be. Sure of its position regarding the final outcome, the Boston Gas Company took things in rather easy fashion, and were at first disposed to allow Messrs. Frost & Co. to take the initiative. The latter parties, however, made no show or pretense of a desire to "cut out the running;" and at the regular meeting of the Board, held on Monday, Sept. 29th, Alderman M. S. Greenough determined upon having a "show of hands." When some routine matters had been disposed of, that gentleman moved that the majority and minority reports submitted by the Committee on Paving be called up, which action was agreed to. Alderman Greenough, by-the-way, started in by referring to a matter which is rather astonishing in so far as it develops a state of affairs hitherto entirely unsuspected as having had any sort or shade of existence within the bosoms of the gentlemen embarked in the business of wrecking, or attempting to wreck, established gas properties. These sublimely unselfish creatures saw fit to question the right of Mr. Greenough to vote on the matter of the petition, and went so far as to intimate that, even were such action justified by perfect legality of form, it would undoubtedly be without the pale of fairness, delicacy, and so on. Such insinuations, were they not so nauseating, would be rather mirth-provoking in their tendencies. Look over the whole list of speculators engaged in the business of building opposition works; study their methods, characterized as they are by every sneaking policy; examine the footprints left behind them in any city or town in which they have operated—what do you see? Is it fairness of method or delicacy of proposition that one remembers as chiefly characteristic of their onslaughts? Let those who have suffered at their hands answer the question. Mr. Greenough, while perfectly certain as to his right and duty in the premises, took the trouble of calling upon Boston's Corporation Counsel, Mr. E. P. Nettleton, and requested that gentleman to give him his opinion as to the legal propriety of the thing. Mr. Nettleton of course supported Mr. Greenough, and there it ended. Not only did Mr. Greenough vote, but dissected the prayer of the petitioners with such accuracy that not an atom or shred of its "plaint" hung together in moral sequence when he had gotten through with it. His brief and pithy explanation of how the Messrs. Frost manipulated the Chicago deal is worth reproducing. The speaker said:

"Take these gentlemen who come here—the Messrs. Frost; I know something about them already. They constructed the new works at Chicago, Ill. The already existing company had a capital of something like four millions of dollars. The new company (the Equitable, I believe) went in and asked leave to cut up the streets, which permission was obtained. The new works were built by the Messrs. Frost at an expense of $1,200,000; those works were paid for by $2,000,000 of bonds. If the promoters placed the bonds at even 75 cents on the dollar they made a handsome thing of it. With the bonds were issued shares, and the subscribers to the bonds had the right to take stock at par. In short, so well was the thing managed by the gentlemen who now propose to benefit the people of Boston by saddling them with another gas company, that they nominally spent $5,000,000 in building the Equitable plant in Chicago, which the people of that city have now to pay interest on in addition to the interest they pay on the capital of the old company."

Mr. Greenough said that gas rates were very low in Chicago just now; but when the end would be reached, through an armistice agreement, prices would soon be restored to a point where both companies would earn money. Mr. G. did not lack for plenty of similar material, and he "pelted them with hot shot" all through the argument. Referring to certain statements made by petitioners, he said that should the Legislature see fit to alter the statutes in relation to the manufacture of water gas, and if it could be shown that water gas could be produced cheaper than coal gas, be proven that it was better in quality, and desired by the people, his company was open to conviction; but his company did not propose to take anything for granted until positive proof of all these things was furnished. Further than that, the Boston Company was perfectly willing to submit its accounts to a commission appointed by the State, and was satisfied that such commission should report whether or not it was selling good gas at a fair price.

When the arguments were closed a motion to substitute the minority for the majority report was lost by a vote of eight against to four in favor, and a motion to reconsider the determination was rejected by a similar ballot.

All praise is due to the Boston Gas Light Company, and the champion of its cause, Mr. M. S. Greenough, for the sturdy and successful manner in which the issue was prosecuted; and the moral effect of the result must be of great benefit to every honestly conducted gas plant in the United States.

The International Electrical Exhibition at Philadelphia, Pa., Held under the Auspices of the Franklin Institute, of Pennsylvania.

By H. C. Adams.

Number II.

Systems of Lighting.—*II. Incandescent Lamps.*—The system of electric lighting by incandescence differs very widely, and in many respects, from that of lighting by the voltaic arc. In the latter we saw that the light was formed by a current jumping across a break in the continuity of the conductor, and that a current of very great intensity, or electromotive force, was required, because it had to overcome the resistance of the break in the circuit caused by the arc; that resistance is multiplied by every arc put in the circuit, and so a current of proportionately increased electromotive force is required as we increase the number of lamps to be maintained. The volume of the arc current is, however, constant for any number of lamps. In the incandescent system the conditions of current are exactly reversed. A current of low intensity is employed, which is constant for any given number of lamps, but the volume or quantity must be increased proportionately with every additional lamp.

When a current flows through a conductor offering great resistance to it, one of its effects is manifested in the generation of heat; and if the current be of sufficient intensity, and the conductor offer sufficient resistance, it will be heated to incandescence and be finally consumed. It is by taking advantage of such action of the electric current that the incandescent lamp is formed. The essentials of such a lamp are: 1st, conditions of heating the conductor to incandescence under which it will remain in that state and not consume; 2d, a conductor that will give sufficient and properly conditioned specific resistance. To explain how the outlined conditions are obtained is to describe the construction of the lamps; and this we shall do by taking up the one most prominent and most familiar to the people.

The Edison lamp, exhibited by the Edison Company, of New York city, takes its name from the world-famous electrician who is really the father of this system of lighting. It consists of a pear-shaped globe about 4½ inches long, air being exhausted therefrom by mercury pumps, in which manner the most nearly perfect vacuum is created. That gives us the first essential—conditions of heating under which the conductor will not consume. In the stem of the globe is hermetically sealed a glass stopper, through which run two platinum supporting wires (platinum being used since any other metal would oxidize), to the outer ends of which are joined copper wires to be connected with the circuit; at the inner ends, within the vacuum of the globe, is supported a small loop of high resistance material. In this filament (as it is technically called) it is vitally necessary to have homogeneity of structure, with uniformity of density and diameter; otherwise one portion of it would offer more resistance, become more intensely heated, and consume more rapidly than another; and thus the life of the lamp would be materially shortened. Here again carbon is selected as the high resistance substance, and Mr. Edison adds the other qualities thus: He imports bamboo rods, strips off the enamel, and takes the fibers immediately underneath, where they are homogeneous in structure and parallel. They are then cut to exact, fine, hair-like proportions by a gauge, being finally baked or carbonized, and, as far as possible, all foreign substances driven off. In the Edison lamp this carbon is given the form of a horseshoe loop, but the shaping varies in nearly all the various systems of lamps.

Now, when the filament is placed in the vacuum of the lamp, and circuit made through it, the resistance offered causes the current to expend part of its energy in heat, and thus bring the filament to incandescence—the degree of same necessarily depending on the volume and intensity of the current carried. It will be readily seen how important it is to have perfection of vacuum, for in just the proportion that this is not reached, so much more rapidly will the filament consume; and as the destruction of the filament renders the lamp useless, the duration of its life is an important factor in the commercial progress of the light. The Edison Company guarantee 600 hours for their lamps; that is, however, merely a statement of average, for they vary from a few hours up to 1,000—going much higher in exceptional cases, attributable to the varying conditions of use and perfection of construction, etc.

The stem of the globe (from which run the two wires leading from the filament) is fitted with an inclosing cylindrical brass case, through the outside band of which one wire is led, the other one being brought down through an insulated metal core in the center. This whole stem is screwed into a socket, just as we screw a gas burner to the arm of a fixture; and through the socket come the branch wires from the main circuit. One wire is brought up the outside so as to make contact with the one brought down through the outside case of the stem; the other is attached to a spring, the end of which rests a slight distance below the central core of the stem which contains the wire from the filament. That spring is attached to the key of the lamp, and when that is turned it works a cam and presses the spring up against the central core, makes a contact, completes the circuit in the lamp, and causes it to light. When the key is turned back, the cam releases the spring, which flies back, breaks the circuit, and extinguishes the lamp. Should the lamp be broken while in action, the admission of a supporter of combustion instantly causes consumption of the carbon, the circuit is broken, and extinguishment ensues; also, if the lamp be pulled out of the socket while in action, the only result is a rupture of circuit and annihilation of light.

In arc lighting, as we saw, the extinguishment or destruction of any single lamp in a circuit causes the extinguishment of every other lamp in the same circuit, except where automatic cut-outs were arranged to prevent such consequence. In the incandescent system, on the contrary, the breaking or extinguishing of any lamp has comparatively no effect upon others in the same main circuit. To tell exactly why that is so would entail an abstruse account of the methods of subdivision of the electric circuit; but we may, in a few words, make a rough statement in the attempt to lead to a better understanding of the radical difference between the two systems. In the arc system there is one continuous circuit of wire running from one pole of the generator to the other, and broken only where the arcs of the lamps, which are directly in the circuit, intervene. Should those breaks become at any point too great for the current to leap across, the circuit will be broken and all the lamps put out. In the other system we may regard the distributing and returning wires as led out parallel to each other, but not connected at their extremities, the connections between them being made at various points along their course by a fine branch wire carried from one to the other through an incandescent lamp. Thus it is seen that each of the lamps is in a short or branch circuit from the main line, and a break in any lamp's circuit will not prevent the current from flowing on to the circuits of the other lamps. Technically, the arc lights are said to be in "simple series," and the incandescents in "multiple arc." The incandescent lamps are liable to be at once extinguished in large numbers—as in mills, factories, etc.; and that would, of course, throw too much current on the remaining circuits, causing danger of overheating and fire. To provide for this a regulator is attached to the dynamo or generator, by which the current may be instantly reduced on such occasions. Behind the sockets of all lamps attached to walls or fixtures are inserted what are called safety-plugs. In the Edison system these consist of little hollow cups of glass, through which the circuit is taken by a wire composed of metal fusible at a very low temperature; as soon as the wires become overloaded with current, and overheated, these fusible wires melt, causing rupture of circuit. Safety-strips are likewise inserted at varying intervals on the main conductor and near the point of delivery from the dynamo, in order to check, as early as possible, any manifestation of undue heat.

In method of distribution the Edison Company follow very closely that adopted by gas engineers. They generate at a central station, and deliver through mains from which branches are carried into houses or factories, after the manner of gas conduits, which, however, they generally avoid, as affording too many "grounds," or short cuts, for the current. In houses the wires are attached to appliances closely resembling ordinary gas fixtures.

Now, the great question arises how to measure the current supplied to the consumer; and in this, too, the Edison system closely follows the gas man's practice. They have a registering meter of interesting and ingenious construction. It is contained in a case (much resembling that of a gas meter) divided into two sections, an upper and a lower one. The main current is taken through strips of German silver in the lower section; in the upper section stand two cells, which are in shunt circuit with the main line below. In each of these two cells are a pair of zinc plates insulated from each other and immersed in a solution of zinc sulphate. When the current passes through the plates and the solution it causes a chemical reaction which removes zinc from the positive pole and deposits it upon the negative pole. Now, it is known how much zinc will be deposited by the passage of one ampère, or unit of volume—viz., 1.224 grammes. The object of using two cells is to have them check each other. At the end of each month the cells are taken out and weighed, fresh ones being inserted in their stead. The difference of weight shows how many units of volume have passed through the meter; and as it is known how many ampères (or what fraction of one) each lamp will consume per hour, the bill can be made out in any agreed form, either per light, per hour, or per ampère. The usual method, however, is to rate it in equivalents of gas jets. It will be noticed that here, as in gas supply, the meter registers only volume.

An ingenious device is inserted to prevent the liquid in the cells from freezing, consisting of a small incandescent lamp placed in the bottom of the case, attached to which is an armature located close to a helix in circuit. This armature is a metallic thermometer so adjusted that when the temperature falls considerably it contracts and touches the helix, which at once acts, bringing the lamp into circuit and lighting it. That furnishes sufficient heat to raise the temperature to the required degree. When the

requisite point of temperature has been reached, the metallic thermometric armature expands, leaves the helix, breaks the circuit, and extinguishes the lamp. We should perhaps say that the current passes along the main street circuit, and does not affect the meter until the lighting of a lamp in the house makes a circuit. As each lamp is turned on it lessens the resistance of the house circuit, and causes a greater volume of current to pass in from the main circuit, and thus through the meter; and as the volume, as we saw above, is proportional to the number of lamps, the increase in the number of lamps lighted will be registered in the meter by the passage of an increased volume of current.

The Edison Company manufacture only incandescent lamps, and make them from ten to one hundred nominal candle power. In working from a central station, however, all charges and calculations are made with a ten-candle lamp as a unit. The only difference between the low and high candle power lamps is in the size of the globe and the larger radiating surface of the carbon filament. The lamp generally supplied is the ten-candle one, although in some places, as in New York city, many sixteen-candle lamps are operated. This company have now some 300 plants, and 60,000 lamps in operation throughout the United States. The majority of those are in large offices, mills and factories of various kinds; but very few as yet have been introduced into private houses. We should say here that this is the only company that has as yet distributed incandescent lamps on an extended scale from a central station.

The Brush Electric Company make quite a display of the Swan lamp, which is operated from their machines. In its essentials this lamp does not differ from the Edison. The filament is a linen thread, parchmentized, and its shape allows of the use of a globe more nearly spherical than Edison's. Instead of being in a horseshoe loop the thread is led in straight, and a round turn taken in its lower end. The effect is to concentrate the light; and instead of the two fine lines of light noticed in the Edison, we notice what seems to be nearly a luminous sphere of filament; and its appearance more nearly approaches that of an ignited gas jet—whence its name, the "Swan Glow Lamp." The lamps are held in the sockets by a set of spring hooks, and safety strips are placed all through the circuits, as described above.

The great difference between this system and the Edison is that it proposes (for it has not yet put it into commercial operation) to make use of a storage battery instead of distributing the current directly from the machines or generators from a central station, as is done by the Edison company. The difficulty of distributing to a distance a current of low tension and high volume, such as is required for the incandescent lamp, lies in the very large and expensive conductors required. Now, by means of this storage battery a current of high tension and low volume can be taken from an arc light machine, by a small conductor, to a great distance; then charged into the battery, and taken thence as a current meeting the required conditions.

The battery is constructed of a series of cells which contain two insulated leaden plates immersed in a dilute solution of sulphuric acid. When the current from the dynamo is sent through these cells and the solution it decomposes the water, the oxygen of which unites with the lead to form an oxide of that metal. In this chemical action electricity, or rather energy, is stored, which, upon the decomposition of the oxide, is given off as electricity again. To state it comprehensively: The action of the current on the cell causes a chemical action between the plates and the solution, which leaves the two plates, or poles, of the cell in a condition of difference of potential; *i. e.*, there is a tendency for the electricity in one to flow to the other, just as a difference of level in water causes it to flow from one vessel to another with which it is connected. After the cells have been charged current may be drawn from them to nearly the amount of the charge; but not quite, for some energy is lost in transitu.

Each of the cells has an electromotive force of two units, or volts; then, by multiplying the number of cells, we may obtain any required electromotive force. As the quantity of the current is determined by the size of the plates, by increasing that we may get a current of any required volume. So the quality of current with which the battery is charged does not at all determine the quality of the current discharged from it. Thus we can charge it with a current from a dynamo generating a high tension, low volume current, suitable only for arc lights, and, by proper arrangement of cells, we can draw off a current of low tension and high volume suitable for an incandescent circuit. The advantage in the use of such a battery lies in it then being possible to use a fine wire conductor to carry the current to a distance from the arc machines, instead of having to use the heavy conductor necessary on account of the great volume of the current when taken from what are called "direct" low tension machines—those generating a current suitable for the incandescent circuit and delivering it directly. Such batteries remain charged for months with small loss of energy, thus making the users of them to some degree independent of machinery. And there is a great advantage in being able to use spare power, or that which would otherwise lie idle. For instance, the Brush company propose during the day to charge these batteries with their arc machines, which would otherwise at that period be idle. Only incandescent lights are run from storage batteries, because the enormous electromotive force required for the arc circuit would take too many cells to make it practicable.

To the battery is attached an automatic manipulating device which regulates the connection of the battery with the charging current. As soon as the battery is well charged, its electromotive force rises and acts on the switching apparatus, cutting off the charging current, and as soon as that force falls, by reason of the discharge of the battery, the charging current is switched on again. The measurement of the current is accomplished by a meter attached to the regulating apparatus just mentioned. It records by clock-work how many hours the current flows into the battery; then the company, knowing the volume of the current and the time of its flow, makes out its bill on that data. These batteries, it must be understood, are for use only near to the points where the lamps to be supplied are operated; for were it attempted to distribute at a distance from them, the same difficulty in conduction would be met as occurs in using direct machines.

The Brush company call their Swan lamps twenty-candle power, claiming that they give greater light than those of the same size of other systems which are rated at sixteen-candle power. They have as yet not at all extended their system, this Exhibition, we believe, being the first public display of their batteries. For isolated plants they manufacture direct incandescence dynamos, when storage batteries could not be reached from central supply machines.

Another extensive display is made by the United States Electric Lighting Company. They exhibit only the Weston lamp; formerly they owned and operated the Maxim, but have discarded it for the new and superior Weston. The latter is peculiar in its filaments, which are made from gun cotton. The gun cotton goes through a long treatment, and finally emerges as a substance called Tamidine, nearly pure homogeneous cellulose, which, when subjected to heat in closed retorts, gives a residual of nearly pure homogeneous carbon, claimed to be of especial superiority in resisting the disintegrating effects of the current. Its life is thus prolonged, and the United States Company guarantee 1,000 hours for it. It differs from the Swan and the Edison in shape. With the general form of a horseshoe loop, it has a series of undulations throughout its length which are said to give better distribution of light and expose a greater incandescent surface. The United States Company have just brought the Weston lamp from the laboratory, and are scarcely prepared as yet to make public the details of the manner in which their extended commercial system will be conducted. They make a very noticeable display of high candle power incandescent lamps, and during the Exhibition brought out for the first time one of three hundred-candle power. That is something new in incandescent lighting, and is quite an encroachment upon the domain of the arc light; for as far as the question between the arc and the incandescent system goes, the moment that these high power incandescent lamps can be made to approach the arc lights in cheapness, they will begin to supplant them rapidly. These new lamps are now run on a method of division of circuit that is a compromise between the arc and incandescent systems; ultimately they propose to run them on what is called simple series, exactly after the manner of the arc lights. They can be run from either a small arc dynamo, or from a special incandescent machine of higher electromotive force than ordinary.

The Bernstein Electric Light Manufacturing Company, of Boston, Mass., make quite an exhibit of a peculiar incandescent lamp. They use a silk filament in the form of a long, hollow cylinder, which they claim gives a very evenly diffused light. It is of comparatively low resistance, and that makes it possible to run it in series, as arc lights are run, or in multiple arc, after the manner of incandescents. The former method is used for street, and the latter for interior, lighting. The lamps are interchangeable, and can be taken from one kind of circuit and placed on the other without any alteration. They run a little series line along one of the aisles of the Exhibition building, where the lamps are directly in the circuit, and the current flows through the filament just as through the arc; here, of course, each lamp must be provided with an automatic cut-out, otherwise, should it fail, they would lose the whole line. Most of the lamps they exhibit are of from 30 to 50 nominal candle power. They display one lamp containing a double set of filaments, the only one of its kind that we have seen in the Exhibition. The whole system is new and just being introduced here and abroad.

Some less extensive exhibits of incandescent lamps are made by the Van Depoele Company, the Stanley and the Richter, all of which have small booths lighted up with their lamps. There are some others exhibiting a very few lamps, systems apparently just hatched out; among these are the Ball, the Acme and the Excelsior companies. Messrs. Queen and Co., of Philadelphia, also exhibit a few Gerard lamps. In none of these specimens do we find any peculiarities worthy of especial or extended mention.

This light can be more elegantly and variously displayed than the arc, and the larger exhibitors have gone to much trouble and expense in the

effort to make a handsome showing. The Edison leads all in the elegance and extent of display. To give some idea of what they have done, we may say that they have at times some 4,400 lamps lighted; and on a large pillar in the midst of their exhibits are arranged 2,600 lamps, only 500 of which, however, are in circuit for lighting. That circuit is arranged spirally about the pillar, and when it is made consecutively through the lines, the light seems to wind about the pillar in different colored lamps with very beautiful effect.

One of the most handsome and effective designs in the building is a booth belonging to the Brush Company, showing a handsomely furnished bedroom and library, where the Swan lamps are burning on chandeliers and brackets. The United States Company have the second largest display, but the lamps are scattered in lines, groups and chandeliers throughout their spaces. In their booth they have a miniature cascade and grotto illuminated by various colored lamps.

In carefully regarding the appearance of this light, one must not forget the gloss that new and tasteful fixtures add. The force of that consideration may be better realized by inspecting the exhibit of Messrs. Bergmann & Company, of New York city, who manufacture the fixtures for the Edison Company, and also paying attention to the fixture exhibit of the Edison Company itself. People who have for years been accustomed to looking upon the stiff, angular gas fixtures in manufacturing designs of long ago, that still adorn, or rather deface, so many of our houses, exclaim at these beautiful and artistic examples. The new shades and globes, while it may seem a paradox, really act reciprocally upon the light and cast a halo about it, at least so far as the judgment of the spectators is concerned, who forget, or rather do not stop to think, that with the same exterior advantages equally beautiful effects are obtained with gas jets.

Messrs. Bergmann & Company display electroliers, as they are called, of all kinds, ornamented by various designs; brackets, fixed or swinging, for any number of lights; drop-lights, lamps, lanterns, etc., in the newest and most "catching" styles, and globes of colored, tinted or etched glass formed about the lamps like the petals of flowers. The effect of the liberal use of such globes is to subdue and tint the light in a way that, as we said, surprises and attracts those who have not been used to the same effects obtained in gas. If the fine display of this department teaches the consumer of gas how much may be obtained by new and improved fixtures, it will have rendered the gas engineers no inconsiderable service.

The incandescent light is vastly different from and superior to the arc light in quality and steadiness. In color it much more nearly approaches gas, although it is considerably whiter than the ordinary gas jet. It seems almost to coincide (in color) with the light emitted by the Siemens lamp, when the latter is burning full and clear. We do not notice in the lights shown at the Exhibition the periodical fluctuations in intensity that are to be seen in many isolated plants. That fluctuation is due to irregularity in action of the driving engine; but here they have taken all precautions to avoid this defect. Whether the fluctuations are present in such small degree or that the reinforcement of adjacent series of lights obliterates them we cannot say; to the eye the lamps seem to burn with very creditable steadiness. In the larger lamps the light emitted is of the same quality, the only difference being in the intensity. Little heat is generated by the lamps, and the hand may be laid upon the globe of one in action without much discomfort.

At present the incandescent light cannot be produced so as to touch gas in cost per unit of effective light. The further economy to be obtained lies in creating more light with less energy; and that is to be accomplished chiefly in producing filaments that may be brought to incandescence with a smaller expenditure of energy than now. What some happy invention might do, of course, no one can tell; but there seems to be no immediate prospect of any advance in that direction.

When statements of comparative cost of gas and incandescent lighting are read in electric light prospectuses, or in newspapers, it must be remembered that all the electricians make an assumption the unfairness of which is manifest. They compare their ordinary sixteen-candle power lamp with a gas jet burning *seven* feet per hour. That such style of comparison is of considerable assistance to them in a demonstration of economy need scarcely be said.

THE DYNAMOS.

The dynamo is the generator to which the power of a steam or other engine is applied, and by which it is developed into electrical energy. The principle upon which it is operated is that which was first discovered by Faraday—*i. e.*, when a conductor, whether insulated or not, was brought into the magnetic field of another conductor through which a current was passing, or into that of powerful magnets, a current would be induced in it. If such a conductor, or a series of conductors, be made to revolve very rapidly between the poles of such magnets, a series of currents will be induced, which, if the number of conductors be large enough, or the revolutions sufficiently rapid, will practically amount to a continuous current. Those currents are induced only when the conductor is at the poles of the magnets, and cease or are neutralized when it passes away from them; and they are alternate—*i. e.*, when the conductor is opposite one pole they will be generated in one direction, and when it is opposite another pole they will be generated in an opposite direction. So they have to be commuted into direct currents (those flowing constantly in one direction) before they can be utilized in electric lighting.

On those principles depend all the dynamos shown in the Exhibition; they vary only in the relative size, shape and position of the magnets and conductor, or armature, as it is technically called.

One of the most important and effective dynamos is that which is displayed by the Brush Electric Company. Like the majority of their exhibits it is the invention of their electrician, Mr. Brush. A description of that machine will give a fair idea of the general mechanical construction of the different varieties, and will show how the induced currents are drawn off and utilized in circuits.

For the clearer comprehension of the subject let the magnets be regarded as large horseshoe magnets, made of soft iron, with their heads or poles enlarged, and their bodies relatively much reduced in size, and wound with insulated copper wire, through which a high current passes making them magnets of great strength. Two of those are used in the Brush machine, and are laid upon their sides with their poles turned inward, so that the poles of one magnet are immediately opposite and corresponding to the poles of the other. Of course, between these poles there will be a very intense magnetic field where the lines of force will be quite numerous and strong. Here is placed the armature or conductor in which the current is to be induced. In the Brush machine it consists of a cast iron wheel, attached to a shaft, which revolves longitudinally between the parallel arms of the magnets; at one end of this shaft is attached the driving belt, and at the other is the commutator where the current is delivered. The ring, or wheel, which rotates between the pole-pieces of the magnets is almost divided in the direction of its circumference, and transversely by deep grooves, the object of which is to prevent heating, and to isolate internally induced currents. At equal distances along its periphery are twelve rectangular depressions, in and about which are wound bobbins or coils of insulated copper wire. Each is insulated from all the others, except that one which is diametrically opposite. The two ends of the wires of the bobbins are then brought out along the rotating shaft and attached to different segments of the commutator. That leading of the wires is the same in every separate pair of bobbins. Now, when pairs of bobbins in the course of revolution are in horizontal planes, they are opposite the poles of the magnets, and currents are induced in them; those currents would ordinarily be in opposite directions in each bobbin, but their connection and winding is so arranged that, while relatively to themselves the current *is* in opposite directions, yet as a circuit it is in one direction. For illustration, we may say that while a horse on a circular race track may be traveling eastward when he is at the south side, and westward when he is at the north side, yet relatively to the circle he travels in one direction. When the bobbins in further revolution rise to a vertical plane there is no current induced in them; they are neutral. But when they have completed a half revolution they are again opposite the poles, but under reversed conditions—*i. e.*, the bobbin which was before opposite the north pole is now opposite the south; and so, as we explained, a current will be generated of different general direction. Whenever the bobbins are in horizontal plane in every half revolution, currents of alternate directions will be induced; whenever they are in vertical plane they will be neutral. That must be understood to enable us to describe a most interesting and important piece of the mechanism—the commutator. That is really an extension of the rotating shaft, and consists of a series of sets of copper segments, which are insulated from each other as sets and as segments. Each set forms a ring or section through the shaft, and consists, in the latest improved machine, of four insulated segments. To two of these segments are attached, respectively, the ingoing and outgoing wires of a pair of bobbins. Now, regard the whole four segments as representing the four positions of the bobbins in one revolution, the two to which wires are attached representing the positions where currents are generated, and the others representing the vertical positions where they are neutral.

Let us begin with the bobbins in the position first above considered. They are then before the poles, and a current is being induced in them which, for sake of explanation, we shall call outgoing or positive. On the commutator rest two sets of copper collecting brushes, connected with the circuit wires; one brush, resting on the upper side, collects the outgoing or positive current, and sends it through the circuit; the other, resting on the lower side, delivers back to the machine a negative or returning current. Well, then, if that segment of the commutators to which one of the wires of the bobbins is attached be in contact with the positive or delivering brush, when the bobbins, as above, are having induced in them a positive current, then it will flow directly through the commutators and brushes and out through the circuit—it being borne in mind that the opposite seg-

ment, to which the other wire is attached, is at the same moment in contact with the negative brush, thus making the circuit complete. And if, when they have made a half revolution, and are having a current of negative or ingoing direction generated, and the segment of their commutator be in contact with the negative brush, then the current will flow in a negative direction in through the machine. Thus, while those currents relatively to the machine are in opposite directions, the commutator arranges that they shall be delivered to the circuit so as to flow in one and the same general direction through the circuit. That is true of every pair of bobbins; and so a current constant in one direction, though composed of an aggregation of currents of relatively different directions, is kept flowing through the armature, out through the circuits and the lights, and back through the magnets, and thence again through the armature in one continuous course.

Now that we have seen how the current is generated, we naturally inquire how its quality is determined; for we have seen that arc and incandescent circuits necessitate very differently constituted currents. The quality of the current generated by any machine is chiefly determined by the size of the wire used in the coils with which it is wound. The volume of current that can be generated depends on the internal resistance of the machine; and if we wind a machine with coarse wire it will furnish greater volume to a circuit than one wound with fine wire, because the coarse wire will carry, as we know, a larger quantity of electricity with less resistance, and so with less tendency to overheat.

The electromotive force of a current is determined by the number and length of the conductors that, in the course of revolution, cut the lines of force between the poles, and it is independent of the area of their cross-section. So that a very great number of windings of fine wire on the armature will produce very high electromotive force, while a few turns of coarse wire will produce low electromotive force. That is true, of course, only when the speed of the armature and the strength of the magnetic field are constant, for any increase in either of the latter increases the force generated. Thus we may manufacture a machine to produce a current of any desired quality, suitable for any size circuit of either system.

The Brush Company make machines for both arc and incandescent lighting systems. In the arc system we saw that the electromotive force was increased proportionately with every lamp; and if half of those in a circuit were suddenly extinguished, the electromotive force of the current passing through the remaining ones would be doubled, and greatly endanger, if not destroy them. Consequently an automatic regulator is attached to the Brush arc dynamo, which consists of what is technically called a resistance-shunt across the magnetic field. Near the point of the circuit where the current enters the magnets a case is set, and through it is taken the wire of the circuit. The case contains a pair of sucking magnets, whose plunger is attached by an arm and lever to a pile of carbons. That is all arranged so as to be a shunt circuit for the main current. As soon as the current is unduly increased in the main circuit by the putting out of lamps, it acts on the two magnets, intensifies their magnetism, raises the plunger, and makes a contact and a shunt circuit through the carbon plates—making it more or less full according to the compression exerted by the lever which the magnets operate, and thus throws more or less resistance into the circuit. That, of course, causes less current to flow on through the main circuit to the magnetic field, and decreases the strength of the latter, and consequently the electromotive force of the current that it generates. As soon as more lamps put in action absorb more of the current, the magnets weaken, throw out the resistance-shunt, and allow more current to flow through them, and so more electromotive force is generated. That, of course, all acts instantly, and serves to keep the current of proper quality.

In the incandescent machine the speed of the armature and strength of the field are kept, as far as possible, constant; and any rise in electromotive force that might occur from an increased volume of current flowing through the field magnets, is counteracted by the operation of a compound shunt winding of coarse and fine wire on the field magnets, so adjusted as to maintain the force at the normal requirement of the circuit.

Now we may see how a driving engine that did not work uniformly would affect the incandescent lights operated by the dynamo it was running. As soon as the speed of the engine increased it would cause the armature to revolve more rapidly, increase the electromotive force of the current generated, and so the intensity of the lights. Thus any fluctuation in the speed of the armature would make fluctuations in the lights, such as we mentioned above were observable in some plants.

The Brush Company exhibit arc dynamos of from 20 to 65 light capacity—the last-named is the largest of its kind on exhibition, and its armature is 30 inches in diameter, revolving 830 times per minute when running full power. The smaller machines are operated much more rapidly, the armature in the 20-light machine making as high as 1,000 revolutions. This Company also manufacture direct incandescent machines of from 20 to 500 light capacity, and have several of them among their exhibits.

As the Edison Company operate only the incandescent lamp, they need only one kind of dynamo. Its peculiarity is that the magnets are upright, with their poles superimposed over an armature revolving between them. Here the armature is a modification of what is known as the Siemens, in which the wires are wound longitudinally along the core. The magnets are noticeable in having very massive cores, for it is Mr. Edison's theory that the presence of great quantities of iron in them largely increases their efficiency. About a dozen machines of different capacity, varying from 25 to 400 lights, are displayed; but interest centers chiefly in the "Jumbo," the huge 2,000-light steam dynamo. This machine is the largest of its kind ever constructed, and occupies some 64 square feet of the floor space. It is about 7 feet high, and has 12 pole-pieces. Here the magnets lie horizontally; in fact it looks like one of the ordinary Edison machines greatly enlarged and laid over on its side. The armature is three feet in diameter, weighs five tons, and is run at 350 revolutions. Its construction is very peculiar. Around the steel shaft is, first, a bushing of wood, and then, at right angles to the axis of rotation, are arranged three or four thousand iron disks, separated by sheets of tissue paper—the object of that being to prevent heating and the generation of Foucault currents. So large is the volume of current this armature carries that copper rods one inch in diameter are used instead of wire for winding. At each end of the shaft are 49 copper disks, parallel to the above-mentioned iron ones; on the periphery of each copper disk is a lug, to which is attached one of the copper rods running on to a lug on a corresponding disk on the other end of the shaft, but just one point in advance. By carrying out that method with each rod and each pair of disks, a continuous winding is effected. From the ends of the copper disks run radial rods that carry the current down to the commutator. A 125-horse power Armington & Sims engine works directly on this dynamo without any intermediate countershafting. The nominal capacity of this machine is 4,000 lights; but of 16-candle power lamps about 1,000 is its ordinary running. Dynamos of this "Jumbo" style are used in the Pearl street station of the Edison Company in New York city, from which they furnish current for 12,000 lamps.

The regulator in the Edison machine is the same in general principle as that described in the Brush arc machine. It consists of a pair of magnets on the field circuit of the machine. When the extinguishment of lamps unduly increases the current, the magnet acts and throws in a series of German silver resistance coils, which allow less current to flow through the field magnets, and so, less to be generated in the armature. That, of course, acts automatically in either direction, as the current is too high or too low.

The dynamo of the United States Electric Lighting Company consists of a pair of magnets set opposite each other, with their poles in vertical plane. A peculiarity observable here is that the pole-pieces from the opposite magnets run together, so that there are only two pole-pieces for the two magnets, instead of four, as in the Brush machine. The effect of that fusion of the poles is to concentrate the magnetic field. The armature is wound longitudinally over a core of disks much after the Edison method. The winding is very peculiar and complicated; and as the first and last windings of the wire are connected it gives the effect of a closed coil. The current is taken off to the commutator by a series of wire loops arranged about the head of the cylinder formed by the armature. The United States Company's incandescent machines are shunt-wound, as described in similar machines of the Brush system. Regulation is maintained by a magnet that throws resistance in or out of the circuit; it is the same in principle on both arc and incandescent machines, save that in the arc it is in direct series circuit with the machine, while in the incandescent it is in multiple arc.

Ten dynamos are exhibited, varying, in the incandescent machines, from 100 to 600 lights capacity, and in the arc, from five to fifty lamps. So far they have done only isolated lighting, consequently no meters have been required; but one is now in course of construction for commercial use.

The Thomson-Houston Company have an arc dynamo of cylindrical form, unlike any machine yet described. The magnets are circular, with their poles drawn in and down the center, so as to make a hollow sphere within the cylinder formed by their bodies. The effect is, of course, to concentrate and intensify the magnetic field. Within the hollow sphere formed by the pole-pieces of the two magnets revolves the armature, which is simply three coils of wire wound about a spherical or ellipsoidal skeleton frame. It is a very simple winding, but gives very good results; the complete enveloping of the armature by the magnetic field tends greatly to enhance its efficiency. From the coils the current is drawn down, as in other machines, to the commutator, on which is a noteworthy device for producing an air blast to prevent the flashing of oil along the shaft, thus permitting the free use of lubricants, which, in other machines, is attended with considerable trouble. The regulator of this machine is also different from those of the dynamos before described. One pair of controlling magnets, in direct circuit, is placed in a case near the dynamo. Those two magnets operate a large electromagnet attached to the machine. When the current becomes too strong the controlling magnets are made to act so as to draw an armature, and make a contact which throws the large magnet into action; the latter acts

on a lever attached to the collecting brushes and draws them up on the commutator to points where the coils are delivering weaker currents—*i. e.*, when they are further away from the intense field immediately at the poles. By that action a weaker current is sent through the circuit. When, by putting on more lamps, more current is absorbed, the controlling magnets weaken, break the contact, and throw out the large magnet, which allows the brushes to return to stronger points upon the section of the commutator.

This company also shows an invention for running incandescent lights on an arc current. The latter is led to a case called a "Thomson-Rice Incandescent Distributor," which serves to divide the arc current up equally among a number of incandescent lamps, and so reduces it as to make it suitable for them. That is accomplished by running it through a series of little magnets which feed it to the lamps, and which act, when one of the lamps is extinguished, to throw in a coil the resistance of which is just equal to that of the lamp cut out; in this manner a balance is maintained.

The "Ball Unipolar Dynamo," exhibited by the Ball Electric Company, is peculiar in having two separate armatures with separate commutators, one for each pole. These two armatures revolve on the same shaft, and by them an almost perfectly continuous current machine is formed. It is claimed that in such construction there is much less heating than in machines of other forms. The Arago Company shows a dynamo whose armature is a thin circular disk, composed of radial coils of wire, which revolves between a score of opposite poles of different polarity. All the other exhibitors displaying lights show producing dynamos for which they of course claim some excellence in one direction or another; but we have mentioned all the principal machines, and our descriptions have covered the main points of difference in form and method of construction. Just as the Jablochkoff lantern remained after we had described all the other arc lights, so there now remains to be mentioned the peculiar dynamo that operates it. All the other machines were dynamo-electric machines; this is a magneto-electric one—where permanent magnets are used, differing from the others in being made of steel, hardened and magnetized, and in that they retain the force for long periods with very small loss. There are eight of those magnets, each about two feet long, and four inches broad, arranged with their poles inward, radially about an axis where the armature revolves. The latter is of ring form, and wound for alternating currents; it revolves 900 times per minute, and a separate current is generated 260 times per second; and so, of course, alternates through the circuit at that rate. As there is no need here of redirecting the currents, no commutator is used, the current being taken off by contact disks placed at right angles to the shaft of the armature.

In the question of the efficiency of these dynamos it will be seen that so many results could be reached in the Exhibition that could not be reached in practical work, that any figures based on what may be accomplished there would be likely to be very misleading. And then the number of lamps per horse-power that any dynamo is seen to be running means nothing, unless we know definitely the candle-power of each lamp at that time. Those measurements are being made, but they cannot yet be had, so we are obliged to defer consideration of them for the present. The *claims* of the different exhibitors run, in incandescents, from eight to twelve sixteen candle-power lamps per horse-power; in arcs, from $\frac{1}{2}$ to $\frac{1}{4}$ of a horse-power per lamp. In practice, however, they probably obtain about eight sixteen candle incandescent lamps per horse-power; and in the arcs consume one, or over one, horse power per lamp in circuit.

The difference in the danger to life in the currents of the two systems may best be illustrated by saying that one may without discomfort take the shock of the incandescent system current directly from the poles of Edison's "Jumbo," while should one come in the circuit of a forty-lamp arc machine, instant death would result.

While the two kinds of currents differ so in their effects on the human system, they unite in the characteristic of involving danger to property in proximity to them. For in the incandescent circuit, just as in the arc, the wires are likely to become overloaded, and thus cause the ignition of adjacent combustibles. It might have been thought, from our description of the numerous devices in the various systems to avoid such a catastrophe, that its occurrence would be out of the question. Not so, however, for here, as elsewhere, trouble arises from the unaccountable and unprecedented freaks that electricity is constantly performing. It is another case of unreliability.

How the insurance companies view such devices, coupled with all the precautions of thorough insulation, even when taken with extraordinary care, as was done at the Exhibition, is seen in the fact that they charge *ten per cent.* on all goods insured there; and even at that enormous rate they do not care about accepting the risks.

So far as we know no accident to life or damage to property has yet occurred. One of the arc lamps in the vault of the main hall burnt up the other evening in full view of the assembled visitors; but fortunately it was not in a position to cause any extensive damage.

In the next issue of the JOURNAL we hope to give an account of a system of lighting that, sarcastic as it may seem, probably attracts more attention than any other in the Exhibition—we refer to the Siemens Regenerative Gas Lamps. We hope also to then make some mention of the gas engines.

[To be continued.]

[OFFICIAL REPORT.]

Proceedings of the Meeting at which was Organized the Ohio Gas Light Association.

MORNING SESSION—WEDNESDAY, SEPT. 17.

Agreeably to the date fixed upon by the signers of the circular call of August 15th last, a large number of gentlemen, representing the gas interest of the State of Ohio, assembled at the Park Hotel, Columbus, on the morning of September 17th, with the object of perfecting the organization of a permanent State Association. At ten o'clock A. M., Mr. E. McMillin ascended the platform, and moved that Messrs. P. W. Huntington and Geo. H. Taylor be chosen to fill the respective positions of temporary Chairman and Secretary. The motion was carried, and the Chairman appointed Mr. Irvin Butterworth as official stenographer.* Mr. A. B. Robinson, of the Columbus Gas Light Company, then addressed the meeting, as follows:

Gentlemen:—Early in the summer our Superintendent, Mr. McMillin, called the attention of the officers of our company to the idea of creating a local gas organization for this State, and in support of his views advanced such cogent reasons that we all speedily became interested in the matter. It was shown that many of the Ohio fraternity were prevented, owing to one cause or another, from attending the meetings of the American or the Western Gas Associations; and we felt that a great many of them would be inclined to see the advantage of having a local organization formed on rules somewhat broader than those governing the already established associations. The idea seemed such a good one that those composing a committee of three, consisting of Messrs. E. McMillin, R. P. Green and myself, set themselves at the task of obtaining an expression of feeling in regard to the matter from the gas men of the State generally. Having gotten a large number of favorable responses, we issued a call (you have all probably received a copy) for this gathering, at which it will be determined whether the Association shall be made permanent. Owing to the fact that midday will see the arrival of a large number of railway trains, I presume the afternoon attendance will be much greater than that of this morning; but indeed I must congratulate you upon this auspicious beginning, both as regards numbers and evident interest. I hope that we will be united in our efforts to make the Ohio Association a success, to the end that its influence may not only be beneficial to ourselves, but that others will follow the example set, and that similar State organizations may spring up all over the country. I think the oftener we meet and confer together in regard to matters pertaining to the manufacture and distribution of gas, the better and cheaper will these things be done. When I became first connected with the Columbus Gas Company it seemed to me that gas men were possessed with great distrust of one another. If some advantage in manufacture had been discovered, the discoverer kept the knowledge closely to himself, as though he feared, did any one else get hold of the idea, injury would be caused him. However, it has now dawned upon all intelligent members of the fraternity that there is no such thing as competition between companies situated in different localities; and that any advance in knowledge made by one may be freely communicated to his fellows. I trust that we shall have the hearty cooperation of all here assembled, and that abundant success will greet our efforts in this matter. I extend the greetings of the Columbus Gas Company to all assembled here, and hope your stay in our city may be both pleasant and profitable.

Mr. McMillin moved that a committee of five be appointed by the Chair for the purpose of drafting a constitution. Carried. The Chair appointed Messrs. E. McMillin, Columbus; Eugene Printz, Zanesville; A. B. Robinson, Columbus; R. T. Coverdale, Cincinnati; J. M. McLean, Washington Court House, as such committee. These gentlemen reported back a constitution modeled after that of the American Gas Light Association, which instrument was read and adopted. It provides that the name of the body shall be "The Ohio Gas Light Association," and names the third Wednesday of each February as date for holding the annual meetings. After a debate as to the most desirable method of nominating officers, the Chair was instructed to name a nominating committee who were authorized to select a list of officials to serve in their various capacities until the termination of the annual meeting of 1885. The nominating committee, comprising Messrs. E. McMillin, Columbus; M. C. Allison, Xenia; H. J. Reinmund, Lancaster; C. H. Welch, Athens, and O. B. Robinson, Columbus, subsequently handed in the following list of officers:

* The JOURNAL wishes here to acknowledge its indebtedness to Mr. Butterworth in connection with this "Official Report."

President—Gen. A. Hickenlooper, Cincinnati.
Vice-President—J. A. Raynolds, Canton.
Secretary—Jos. M. Bate, Tiffin.
Treasurer—P. W. Huntington, Columbus.

The gentlemen named were all duly elected by ballot. Mr. Huntington was also chosen as temporary Treasurer to take charge of such moneys as were received during the course of meeting for organization.

Mr. McMillin announced that the afternoon session would be opened with an address by Prof. S. H. Douglas, of Ann Arbor, Michigan; he also invited those present to pay a visit to the Columbus Gas Works. The meeting then adjourned, to reassemble at two o'clock, P. M.

Afternoon Session.

The Association was called to order promptly on time, and the following gentlemen were in attendance:

J. Anderson, Ironton.	J. A. Raynolds, Canton.
M. C. Allison, Xenia.	Jas. B. Smallwood, Baltimore, Md.
W. T. Bowers, Hillsboro.	J. H. Walker, Jr., St. Louis, Mo.
Jos. M. Bate, Tiffin.	N. Wilkiemeyer, Lancaster.
R. T. Coverdale, Cincinnati.	P. W. Huntington, Columbus.
C. M. Converse, Delaware.	Geo. S. Harris, Mansfield.
J. S. Connelly, Pittsburgh, Pa.	J. A. Harris, Philadelphia, Pa.
Prof. S. H. Douglas, Ann Arbor, Mich.	Richard Lee, Piqua.
E. S. Furnell, Albany, N. Y.	E. McMillin, Columbus.
F. Fabing, Freemont.	Wm. McDonald, Albany, N. Y.
John Fullager, Cincinnati.	W. W. Prichard, Ironton.
A. M. Hammond, Cadiz.	A. B. Robinson, Columbus.
M. McMillin, Marietta.	H. J. Reinmund, Lancaster.
Jas. McCann, Portsmouth.	F. A. Stacey, Chillicothe.
Jos. M. McLean, Washington C. H.	G. H. Tayler, Warren.
Eugene Printz, Zanesville.	C. H. Welch, Athens.
Henry Ranshaw, Cincinnati.	

Address of Prof. Douglas.

Prof. S. H. Douglas, of Ann Arbor, Michigan, was introduced to the Convention, and spoke as follows:

Gentlemen:—Mr. McMillin made a decided mistake when calling me out in the manner in which he has done; it is very evident that he knows me not. One thing I can say to this assemblage of gas men—I never before made a speech in my life, consequently this must be set down as a "maiden effort." Thousands of times have I lectured before my class in chemistry; still such addresses cannot be considered in the light of speeches; therefore, should I make sad mistakes, the gentlemen must make due allowance. Sitting at the dinner table this noon, I asked our friend, McMillin, what I should talk about in order that what I might say would be of interest to my auditors. He answered, talk about the "A. B. C." of gas making; and this advice I will try to follow. It is quite true that every one should be grounded in the principles of his profession; and I fear it is also true that many men at present in charge of gas works have never learned even the primal points involved in the business of gas manufacture. Undoubtedly they are excellent men, and, in their way, possibly make good managers. Many of them have grown up from the lower grades of the business, perhaps having begun as stokers; such may be worthy men in every personal respect, still they have not become familiar with the first principles of chemistry as applied to the business of gas manufacture. Acting upon Mr. McMillin's suggestion, I shall say a few words upon the importance of learning the scientific principles involved in the study of gas lighting.

To begin with, I think these gatherings of gas men have a most excellent effect in this very direction. They stimulate healthful inquiry, and the result is that the knowledge gained is applied, with benefit in every case, to the routine of ordinary everyday duty. Take the gas burner, for example. We should all know that there is a great difference in these appliances, and yet it is rather the exception than the rule for those in charge of gas plants to teach the consumer about the sort of burner he should use. Prof. Douglas went on to illustrate some of the many simple things that he considered every gas man should be thoroughly conversant with. He asserted that many a gas company would be saved from imposition if its manager had a knowledge, even though slight, of the chemical principles which were at the bottom of the business. As a case in point he related the following incident:

Last summer a representative of certain water gas patents came to Ann Arbor with the view of convincing me that I ought to change my coal gas plant into a water gas system. I happened at the time to be in the neighboring town of Jackson, whither I had been called, by the manager of the gas works there, to consult in regard to some changes that were under advisement. Being told where I was, the water gas man followed me up to Jackson—a distance of some forty miles. Upon his arrival he immediately set at work to convince me of the policy of becoming a convert to his ideas. I said that I did not then have leisure to discuss the point with him, and added that he would probably save time and trouble by not persisting in his arguments, as I considered his system worthless. However, I invited him, in case he wished to persevere, to come on to Ann Arbor when I had gotten through with the consultation at Jackson. It is almost needless to add that he was on hand at the appointed time, and at once entered into a glowing description of what could be done in making gas under the system which he represented. While rattling off the different advantages mentioned, I occupied myself in taking down memoranda of his statements. He said he used so much naphtha, and so much coal—so much of one thing, so much of another—and obtained, in the final result, such a quantity of gas. I calculated the specific gravity of his gas; and when he had finished his story I said: "Now, my friend, listen for a moment. I have been making memoranda of what you have been saying. You use so much material, and the gas product of that material is so much; according to your own figures the gas product weighs more than the material you have employed in its generation!" "Is that so?" he exclaimed; and I requested him to figure it out for himself, adding, "Now, this is an impossibility. You may just as well say to me that you can lift yourself over the fence with your boot straps as to say that you can make a greater weight of gas out of a lesser weight of material." He said, "I guess I had better not talk to you on this subject any further, and probably had better take my leave;" and my answer thereto was "That I thought so too."

The Professor, continuing, said: I give this as an illustration of what every gas manager can do, and possibly so save his company many thousands of dollars; and such knowledge is certainly embraced in the A. B. C.'s of the business. It will have to be admitted that by far too large a proportion of the fraternity are insufficiently well versed in the literature of our art. How many of them are possessed of books of a scientific and technical character treating of the chemistry, as well as other branches, of the industry in which we are engaged? King, Wagner and other authors often furnish, through the pages of their volumes, many hints that will lead the engineer or superintendent out of difficulty. Then, again, illustrating the value of technical knowledge in another direction. We hear a great deal about the electric light, and how cheaply it may be generated, etc. I venture to say there is not a man in this room conversant with the principles of the conversion of forces who will not say in an instant that he has no fear whatever of the electric light when the subject is brought down to the matter of dollars and cents. This electric topic is one which every gas man ought to be thoroughly posted in; but your own observation will show that very few are familiar with it. Investigation will show that, as at present developed, electric lighting cannot be considered as commercially successful; and that this assertion is borne out by actual facts, look at the various electric lighting companies and see how few dividends have ever been earned by them—and all this notwithstanding the high scale of prices charged for the light supply. In the old countries we note the electric lighting bubble has collapsed—with the shares rated as not worth five cents on the dollar. The city of Paris, France, which not many months ago was bathed almost in one continued blaze of electricity, has tabooed it; while recently on a visit there I did not see a single arc lamp. In London, England, the lamps are few and far between, where formerly they existed in great plenty. The novelty has worn off, and with that prop shattered it failed to stand the crucial test applied by commerce—the test of cost. The electric light moves with faster paces in a new country, where people are ready to endorse for a time anything possessing novelty; but merit, in the long run, must tell.

This brings us back to an estimate of what the American gas man may accomplish with the aid of improved burners. If people want more light (the electric craze has certainly educated them in this wish), show them how to use gas in obtaining it. Look at what has been done in my own town, where an electric lighting company has lately started operations. Many of our merchants were desirous of introducing electricity into their stores and warehouses as a lighting agent. I said to them, "Wait a moment; do not put in this lighting medium, as I can furnish you with a better one that will cost you less money. If you are willing to try the experiment I will guarantee its success." I ordered some specimens of the Siemens burners, had them properly set, and calmly awaited the verdict. There could be only one result; and everyone admitted that electricity was nowhere in the comparison.

So I would say, study your business with close application, and watch carefully (and that, too, scientifically) over all these seemingly trifling details. One of the advantages gained from these gatherings of gas men is that those present acquire the habit of studying the work they are engaged in, and thus not only benefit themselves, but benefit their fellows and their communities. I might go on illustrating these things over and over again; but each illustration would only bring us back to the initial point—that it is incumbent upon us to thoroughly learn the first principles involved in the production of gas; and should we all do this, our processes of manufacture

must of necessity be carried on with much greater economy and profit, accordingly as that knowledge is imbibed.

Mr. J. Fullager (Cincinnati)—I must say one thing in regard to the managers of our very small works supplying themselves with all these scientific and technical publications. I would like to ask Prof. Douglas how they are going to do it. Some time since a party requested me to find him a superintendent; I thought of a young man (a right smart one) who might take the place. He made a written application; and what do you suppose was wanted of him? Well, all that he would have to do would be to repair meters and lay mains; understand all about an engine, and be a finished mechanic, a good chemist, a laborer, an extra stoker, and a "purifying man"—all for $40 per month!

A Member—Did they want him to do the lighting also?

Mr. Fullager—I hardly know about that; but what I have related is an actual fact. There is the trouble with our small works—instead of taking a young man into the place and giving him an opportunity of growing up with them in their service, they will look out for one possessed of all the qualifications mentioned, pay the salary of $40 per month, and then expect the newcomer to earn a 20 per cent. dividend for them in the first year. I think the best place to acquire the A B C of gas making is right in the retort house—close to the fires of the furnace. Indeed, a young man generally found more money was to be made in keeping up the heats, and watching things closely about the works, than by poring over scientific or technical books. If gas companies would see fit to employ young men and let them grow up with them, allowing them an opportunity, in addition to their practical experience, for a study into the scientific principles of the business, a result would be that the next generation would see the right sort of engineers and superintendents. The youngsters in charge of small plants had no time to go outside of their own works, nor could they afford to lose two or three days (with consequent loss of pay) in the effort to obtain "pointers" from a larger works twenty miles away. Under such a condition of things it is quite patent that the best methods of procedure could hardly be acquired.

Prof. Douglas replied that Mr. Fullager's opinions were undoubtedly all right; but he (the Professor) merely endeavored to show the necessity and importance of the principles involved in the business. He said that when a gas company employed a superintendent at the rate of $40 a month, the labor secured must be of a poor quality, and it was hardly to be wondered at that such a superintendent would fail to earn a dividend. Neither should they go to the other extreme, and retain a man who was possessed of only a theoretical, scientific knowledge—one of the sort sometimes denominated an "eddicated cuss." That was not the kind or quality needed in the business.

Mr. E. McMillin then invited Prof. Douglas to tell the Convention something about the purifying material used at Ann Arbor; but as the discussion took something nearly akin to that brought out at the St. Louis meeting of the Western Gas Association, we will not reproduce it. We might add that Professor Douglas was not in accord with the ideas advanced by "Delta" (see JOURNAL for Aug. 2, 1884), in his series of "After-thoughts."

Mr. Joseph M. Bate (Tiffin) said that he had promised to read a paper before the meeting on the subject of the electric light, but had decided that he would orally deal with the topic. He then gave an entertaining account of the experience gained by the residents of Tiffin in their dealings with an electric light company which had introduced itself in business at that place. This experience had been most unsatisfactory, both to the people and the electric promoters, for all of which he was thankful. He said the Tiffin Gas Company had not lowered the selling price of gas in order to meet the threatened inroad on its consumption. He could report to the gentlemen present that electric light at Tiffin was rapidly losing ground.

Prof. Douglas told of an article that had been read by him, and which he said was worthy the perusal of every gas man. It was descriptive of the International Electrical Exhibition now in progress at Philadelphia, Pa. He said that the various electrical appliances there exhibited for the production of the electric light could be better characterized by the name of "electric toys" than any other appellation he could then think of. He maintained that the same quantity of coal required for consumption in the generation of the electric current would, if carbonized in a gas retort, produce more light than that given off in the shape of electric light. It was simply a case of the conversion of force, and an immense percentage was lost before the carbon points were reached. He did not believe that electric lighting could ever be made a commercial success; it seemed really an attempt at making something out of nothing.

On motion, Prof. Douglas was then elected an honorary member of the Association.

Mr. E. McMillin read a paper on the subject of the "Registry of Meters," in which the author recounted the results of a series of experiments made by him in respect to the question treated. The outcome of the tests confirmed the experimenter in his belief that a greater percentage of consumer's me ers registered slow than fast. The discussion that ensued developed evidence corroborative of the opinion advanced by Mr. McMillin.

Mr. Fullager suggested that subjects for debate at the meetings be announced beforehand, as he believed such an arrangement would be better calculated to elicit interesting and profitable discussions than the usual presentation of papers.

Mr. Bowers (Hillsboro) raised the question of the utility and economy of employing exhausters in small works. He asked for an expression of opinion as to the smallest plant in which an exhauster could be employed with profit.

Mr. Bate said he had increased his make of gas some 15 per cent. when using an exhauster.

Mr. A. M. Hammond (Cadiz) asserted that his plant was probably as small as any other in the State; still he would not be willing to dispense with an exhauster.

Mr. Fullager strongly recommended the running of an exhauster in plants of any size.

The meeting then adjourned, to reassemble at 7:30 P.M. Immediately after adjournment the Association, in solid phalanx, made a visit of inspection to the works of the Columbus Gas Light and Coke Company, Messrs. McMillin and Huntington doing the honors.

EVENING SESSION.

Promptly at the appointed hour the Chairman called the members to order, and read a telegram from Gen. Hickenlooper conveying the information that he accepted his election to the Presidency of the new organization. The news was received with great applause. The question of selecting a locality for holding the first annual meeting was then brought up. After some discussion the city of Cincinnati was chosen.

Mr. McMillin then read a paper on the theme of "Observations of a General Character on the Manufacture of Coal Gas."* This communication led to an interesting and spirited discussion, tending chiefly in the direction of the best system of placing and disposition of the various pieces of apparatus.

Mr. Fullager thought regenerative furnaces could be profitably introduced into a works of even the smallest size He recommended placing the exhauster just before the purifiers; and added that he would not use a steam jet exhauster under any circumstances.

Mr. Bate, on the contrary, said he constantly used a steam-jet exhauster.

Mr. Tayler (Warren) said he obtained a yield of over 5 cubic feet to the pound without the aid of an exhauster; but he would not say what the candle power was.

When a lengthy interchange of ideas on divers subjects of the foregoing character was brought to a close, a vote of thanks was extended to Mr. McMillin for the papers read by him; the landlord of the Park Hotel also received a vote of thanks for the excellent manner in which he had accommodated the members. The Association then adjourned, to meet in Cincinnati, Ohio, on the third Wednesday (18th) of February, 1885.

The "Stockport" Gas Engine.

Engineering gives the following description of a gas engine called the "Stockport," which is being placed on the English market by Messrs. J. E. H. Andrews & Co., of Stockport, England. The firm of Andrews & Co. will be noted also as prominent in connection with the Bisschop gas engine. *Engineering* says:

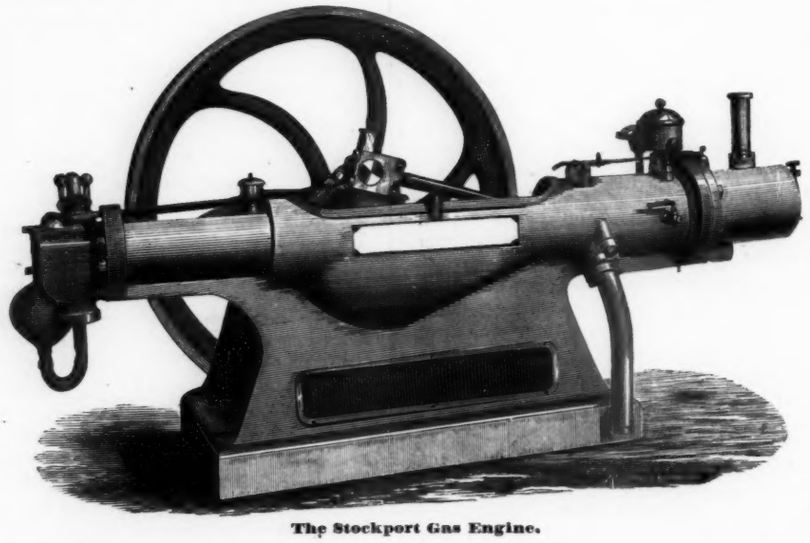
The Stockport gas engine is of the type of those which compress the charge, and it has an explosion at every revolution, whether the engine be lightly or heavily loaded. As will be seen from the illustration, there are two cylinders arranged on the same axial line, one serving to draw in the combustible mixture of gas and air, and the other acting as the working cylinder in which the charge is exploded to produce power. The pistons of these two cylinders are connected by a trunk, so that they are in rigid union, moving simultaneously in the same direction. The central part of this trunk, in the free space between the two cylinders, is partly cut away, so that for a portion of its length it is no longer cylindrical, but is rather less than half a cylinder. This is for the purpose of accommodating the connecting rod, which is pivotted at one end to a pin in the center of the trunk, and at the other end to the crank-pin which works in the reduced portion of the trunk. The whole arrangement recalls some forms of steam pumps, with the crankshaft midway between the steam and the water cylinders.

The cycle of operations, to use a phrase which became stereotyped in the trial of Otto vs. Linford, comprises one revolution only, and is very easy to follow. Commencing with the explosion, the working piston is driven forward by the force of the expanding gases, which follow it almost to the termination of its stroke. Just before it reaches the end, however, it passes an open exhaust port, communicating through a pipe with the outer air.

* This paper will be given in a subsequent number.

At this point the gases have, in the normal conditions of working, a pressure of about 30 pounds per square inch, and they instantly discharge themselves until the cylinder and combustion chamber are filled only with products of combustion at atmospheric pressure. At this moment the slide valve opens communication between the cylinder and a reservoir (to be described later), filled with combustible mixture under moderate pressure. This sweeps out whatever remains of the exploded charge, driving it before it, without sensibly mixing with it, and completely filling the cylinder, before the piston, which has now commenced its return stroke, covers the port. All this occupies but a very slight portion of the piston's stroke, but as it travels very slowly for a considerable angle of the crank on each side of the center, there is ample time for the evacuation of the spent charge and the introduction of the new one. The piston now moves inward, driven by the energy of the flywheel, and compresses the mixture into the combustion chamber at the end of the cylinder, until the crank again passes the center, when the ignition port is opened and the cycle is complete.

Turning now to the other or supply cylinder, and commencing at the same point—namely, at the moment when the explosion occurs—we find the cylinder filled with an intimate mixture of gas and air. These two fluids are intentionally blended as completely as possible, stratification or the introduction of air cushions being purposely avoided, as the thorough ventilation of the working cylinder at each revolution keeps the temperature of the metal and the residual gases below the point at which they will ignite the incoming charge. As the piston moves backward it forces the mixture into a reservoir in the bedplate of the engine, where it is momentarily retained, and then on its outward stroke it draws in a fresh supply. Thus it will be seen that when the working piston is propelled by an explosion, the supply piston forces a charge into the reservoir ready to sweep out the products of combustion, and to take its place ready for compression; and when the working piston is compressing this charge, the supply cylinder is being filled afresh.



The Stockport Gas Engine.

As there is an explosion at every revolution, it follows that the strength of the charge must be varied to suit the load on the engine. This is done by a governor which controls a small equilibrium valve in the gas passage, raising and lowering it as the speed increases and decreases. There is, however, a limit beyond which this method of regulation cannot be carried, for if the mixture be made too poor it will not ignite. If an engine were running absolutely empty, it might easily happen that the poorest ignitable mixture would provide too much power, and the result would be an excess of speed. To prevent this the governor, besides controlling the throttle valve, determines the position of a stud on a lever connected with a valve on the cylinder. At a given speed the stud is moved into the path of a tappet, and opens the valve when the compression is taking place in the working cylinder. The result of this is that a part of the charge is driven out of the cylinder through a pipe which ends in the air inlet pipe to the supply cylinder, from which the rejected charge is drawn at the next stroke, and delivered again to the reservoir.

Besides the above-mentioned tappet valve, which is usually out of action, there are only two valves in the engine, both of them slide valves, and both operated from the same eccentric. The working cylinder valve is driven direct, as in a steam engine. The supply cylinder valve is worked by an arm at the end of a small weighshaft, the other end of which carries a slotted lever gearing with a pin projecting from the strap of the eccentric. This pin follows a curved path, moving backward and forward in the slot, the result being that the angular velocity of the lever, and consequently the speed of travel of the valve, varies very greatly at different parts of the stroke. The valve of the supply cylinder is a flat plate working between the face on the cylinder and a back plate, in which there is a cavity in constant communication with the gas pipe, after it has passed the throttle valve. There are three ports in the cylinder face, one opening into the air, one to the cylinder, and one to the reservoir; and there is a cavity in the face of the valve, with a number of small passages leading from it to meet the cavity in the back plate. During the indrawing stroke the gas enters the valve in fine streams, and the air sweeps across it at right angles as it is drawn to the inlet port of the cylinder. At the end of the stroke the movement of the valve cuts off the gas and air, and puts the cylinder port in communication with the pipe leading to the reservoir. The whole arrangement is exceedingly simple, and resembles the valve of a single-acting steam engine.

The valve of the working cylinder is likewise a flat plate valve. It slides on the side of the cylinder, not the end, just in the same way as the valve of a steam engine. Its function is to put the cylinder in communication with the reservoir when the piston passes the exhaust port, and to break the communication when the piston again closes the ports. In addition to this very simple operation it has to effect the ignition of the charge. The master light burns in a recess or chimney formed in the end of the cylinder, or, more correctly, in the combustion chamber. It has an opening through the valve face, and past this opening there travels a cavity in the valve. This is supplied by gas, which becomes ignited, and in this condition is carried to the main port of the cylinder, the whole width of the cavity being presented to the port at once, thus insuring the certainty of an explosion. The valve is cored out for the circulation of water, which enters and leaves through flexible connections; and by this means its temperature is kept at a point where there is little fear of seizing or cutting. It is held up to its place by a back plate with springs under the nuts which secure it, and is further retained by clamps on the studs. These give way as the valve expands, and allow it to obtain just the amount of room which it requires.

The gas consumption of these engines is 35 cubic feet of gas per hour per actual horse power, or 20 feet per indicated horse power when working at their full capacity. The average pressure is 73.69 pounds per square inch, the initial and terminal pressures being 210 pounds and 30 pounds. The motion is regular, since there is an explosion at each revolution, whether the load be light or heavy, and a sudden increase of work cannot stop the engine.

Although our account is necessarily brief, and in the absence of detailed illustrations cannot go into particulars, yet it will serve to convey a fair idea of the main features of the latest venture in gas engines, and will show that it enters the market with every prospect of success. Its regularity will commend it to electric light engineers who have incandescent lamps to drive, and to all who require steady turning, while its general simplicity and its compact design will attract users who do not understand complicated machinery, and fear to introduce it into their premises. The resemblance to a steam pump is so close that a man who can manage the one may understand the other, and may undertake its supervision without any special training.

The Lighthouse System of Canada.

At the Montreal meeting of the British Association for the Advancement of Science, Mr. W. Smith, Deputy Minister of Marine, Ottawa, read a paper (before the Mechanical Section of the Society) on the above named topic. In his opening remarks the author said that the lighthouse system of Canada was free from any charges to the shipping coming to Canada. There were over 500 lighthouses under the Goverument of Canada, of which rather more than half were on the sea coast; the remainder being on the inland lakes and rivers. Mr. Smith explained the exceedingly low cost of management, it having been deemed expedient to build a great number of cheap but useful lighthouses to light up our national highway with as little delay as possible, and these are being replaced gradually by stronger and more durable structures. The system is directed by the Marine Department at Ottawa, but is also divided into a number of districts, each of which has an agent to manage it, with an inspector, and, in some cases, an engineer on his staff. Mr. Smith also referred to the gratifying report of the English inspectors who visited them some time ago, in which they spoke in high terms of the economy and efficiency of their system. Speaking of the progress they had made, he stated that in 1867 there were 198 lighthouses and two fog-whistles in the Dominion, while at the present time there were 570 lighthouses and 36 fog-whistles. They had spent in constructing these additional lights and whistles $1,955,620. Mr. Smith concluded by stating that in the whole of Great Britain and Ireland there were only 350 lighthouses.

Sir James Douglas, engineer to Trinity House, England, also read a paper on "Improvements in Coast Signals." He said that the successful development of the maritime commerce of any country must, to a large extent, be dependent upon the perfection of coast signals for the guidance of mariners. After having referred to the old system, he said it was now possible at any coast signal station to provide trustworthy and reliable signals which should be efficient in all the varying conditions of the atmosphere, and sufficiently distinctive in character to enable the mariner to determine accurately his geographical position. Speaking of the various intensities of lights, he said that the electric light, with an intensity of 60,000 candle units, was now found to be practical and reliable for coast lights, and to far outstrip all others. Exhaustive experiments had been tried with mineral oil, coal gas, and the electric arc; but the results had not yet come to hand. On the English coast they were converting as rapidly as possible all fixed lights into occulting ones. There were throughout the world about 4,900 coast signals; of these 80 per cent. were flashing lights and 1 per cent. were occulting lights. Reference was also made to the siren fog signals, and the details of the recent construction and lighting of the new Eddystone lighthouse brought an interesting paper, which was frequently applauded, to a conclusion.

Oil Refuse for Steam Raising.

Iron Age notes that a new invention for the application of oil refuse to steam raising has recently been brought out in Scotland, and, as usual with nearly all new devices, especially those designed to utilize waste products, the most extravagant ideas are entertained as to its ultimate commercial value. From the rather general accounts which have thus far reached us we find that the apparatus is being tried at the Forth Bridge Works, where crude shale oil is used as a substitute for coal in one of the engines, which is driving the air-compressing machinery. The oil, which is of a thick consistency, is at present almost a waste product, being the residue after the distillation of the commercial oil from the shale. The oil, according to an account now before us, is stored under pressure in a tank, near the furnace, the two being connected by tubes. The fire-bars of the furnace are taken out, and a cylindrical retort is suspended in the furnace and surrounded by a spiral tube. From the oil reservoir and from a water main two pipes with valves convey oil and water to the retort and the coil. The retort being heated, the water valve is slightly opened, and a fine stream passing into the retort is converted into steam, which is carried through a superheating coil to a jet underneath the retort, from which jet it issues. The oil is then admitted in the same manner, and carried by another heating tube to the same jet, which it reaches in a nearly gaseous state. It is then caught by the superheated steam and thrown against the convex bottom of the retort, the force of the impact breaking up into vapor any portion of the oil which the heat may not have already converted into gas.

In a short time, continues the article, the retort and heating tubes become red-hot. The steam has become a dry gas, which is thoroughly intermixing with heated carbon. The force of the jet sucks into the center of the flaming gases a current of air, which completes their combustion without producing smoke, dirt or residue. The result of the whole process is almost perfect combustion—an immediate and intense heat which consumes all the products, or, in other words, leaves no residue to be cleared away. The advantages claimed by the inventor of this system are that the retort acts, first, as a boiler or steam generator to start the fire; second, the retort is an atomizer, breaking all possible lumps into atoms; third, the retort is a deflector or director of the flame, distributing it equally to all parts of the furnace; and, fourth, its internal cubic area acts like the air chamber of a pump to keep a steady flow from the jet. The experiment—for it can be regarded only as such at present—is stated to be giving every satisfaction. While this may be the case, it is questionable whether in the end commercial success would follow, and, while yet in the experimental stage, it would be by no means unusual should the invention show the experiences of many others in kindred fields and now long forgotten.

Chemical Actions with Carbon and its Compounds.

According to the London *Journal*, a paper presented by Mr. G. Gore, F.R.S., to the Birmingham Philosophical Society, described the following experiments, which the author had prosecuted with the object of finding some new reactions in which carbon is set free in its elementary state, and also to discover new facts respecting carbon and some of its compounds:

Coal gas was passed over red hot peroxide of iron in a state of fine powder. It set free metallic iron and carbon as a fine black powder.

By passing coal gas over fused argentic flouride in a platinum boat, at an incipient red heat, all the silver salt was reduced to metal; hydrofluoric acid was formed; and a little carbon was separated as a black powder mixed with the unfused silver.

Coal gas was passed over argentic chloride just below its fusion point; also over chloride of lead in a state of fusion, until the salts were quite reduced to metal. In each case, but most with the silver salt, carbon in the state of a fine black powder was set free, and was obtained on dissolving the residue in dilute nitric acid. The chlorides of copper and cadmium were similarly treated. The former was slowly reduced, and some carbon liberated; the latter was not decomposed.

By passing coal gas, during several hours, over fused iodide of silver in a glass retort, at a red heat, only a comparatively small portion of the salt was reduced to the metallic state. No carbon was detected.

Mixtures of carbonic anhydride and hydrogen, carbonic oxide and hydrogen, and of all three of these gases, were passed through red hot glass tubes, and also over red hot platinum foil; but in no case was either vapor of water formed or carbon eliminated. By passing a mixture of carbonic anhydride and hydrogen through a red hot iron tube containing iron turnings, no decomposition occurred.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A Gas Man Running for Congress.—In the last issue of the Journal we gave the case of Mr. Jno. M. Hill, of Concord, N. H., as an instance of even how a "gas man" may be favorably regarded by his fellow citizens. Probably no other person connected with the business is better known to the fraternity of this country than Mr. Thomas Butterworth, President of the Rockford (Ills.) Gas Light Company; and from the latest developments he appears pretty thoroughly known to the people at large of his own State. That the knowledge of him there is in his favor will be all the better appreciated when we state that although a staunch Democrat in politics, he carried his district (a strongly Republican one) in 1868, being in that year elected to a seat in the Illinois State Senate by a phenomenal majority over his competitor for the honors. This year he has again been chosen as the standard-bearer of his party, the Democratic Convention of the Sixth Illinois Congressional District having, on the 24th of last September, named him as their choice to represent them in the next House of Representatives. We hope that Mr. Butterworth will be successful in his candidacy, and that a gas man "good and true" will represent the 6th Illinois District in the new Federal Congress.

Suffocated by Gas.—At about two o'clock, P. M., on Wednesday, October 8th, the odor of escaping gas became unpleasantly prominent in a small hotel located at No. 125 West street, New York city. Investigation of its source led to the breaking open of the sleeping apartment occupied by a lodger named John Hess. Hess was found in bed in an unconscious condition; he had retired at a late hour on the previous morning, and it is supposed that he had "blown out the gas," as the bracket burner was turned full on. He was taken to the Chambers Street Hospital.

The Price of Gas Increased at Baltimore, Md.—The inevitable result has been finally reached in the case of the Baltimore gas war, and the only thing to wonder at in connection therewith is the fact that hostilities were kept up for such a length of time. It appears from an Associated Press despatch, dated October 8th, that the negotiations which have been pending between representatives of the rival companies (the Consolidated and Equitable) were recently brought to a satisfactory termination. It has been agreed

that all active competition shall cease; that a certain division of territory will be made; and that the selling price of gas is to be fixed at the rate of $1.60 per thousand cubic feet. It is reported that the overtures looking to a settlement of the matter proceeded chiefly from those interested in the financial management of the Consolidated Company, and it is quite easy to understand that such should be the case, since the Consolidated staggers under a burden of capitalization load of close on to ten millions of dollars, while the Equitable has only to carry in the neighborhood of two and a half millions. At any rate, they have agreed to "bury the hatchet," and give the consumer a chance to pay sixty cents a thousand more for his light supply than the figure at which he has obtained it during about the last four years. The aforesaid Baltimore consumer is deserving of no pity; indeed, on the whole, he is rather lucky to get off so easily, for there was nothing to prevent the "truce figure" from having been placed at $2, or even more. Thus do we once more behold a nice illustration of how opposition in gas supply serves the public.

Natural Gas at Washington, Pa.—In our "Item" columns, issue of September 2d, we gave a short note in which it was stated that the inhabitants of Washington, Pa., were being supplied with natural gas for heating and cooking purposes. In the same note we invited Mr. Jno. C. Hastings, Secretary and Treasurer of the Washington (Pa.) Gas Light Company, to give us some particulars regarding the cost, etc., of the natural gas supply. The gentleman very courteously acceded to the request, and through his kindness we are enabled to furnish the following details:

Washington, Pa., Oct. 2, 1884.

To the Editor American Gas Light Journal:—In regard to the successful use of natural gas for cooking and heating purposes, I fear the subject is not yet thoroughly enough understood in this locality to enable me to send you much precise information concerning it; but I forward herewith such particulars as I have collected. The People's Heat and Light Company own two very good natural gas wells, both of which emit what is termed "dry gas"—*i. e.*, a gas flow unaccompanied by any mixture of either salt or fresh water. Both of the wells are located to the north of Washington, the nearer of the two being one mile, and the second about three miles from the borders of the township. They lie close to the banks of Chartiers Creek, as also to the tracks of the Chartiers Railroad—a railway connecting our town with the city of Pittsburg. Well No. 1 (or that nearest to Washington) is connected with the point of distribution by means of a six inch wrought iron main, and from this conduit are run off through the streets branches varying from three to six inches in diameter, and hitherto the supply has all been derived from the well termed No. 1. Recently the company determined upon connecting both wells, and are now engaged in putting down the needed link—a main similar in size and description to that with which the first was fitted. It is estimated that twelve miles of supply pipes have been buried underneath the roadways, and the gas has been introduced into close on to four hundred houses. At present the gas is used only in cooking stoves; but in the fall and winter seasons it is intended that grates and heating stoves will be supplied with the gaseous fuel. As far as the prices charged are concerned, I believe the schedule calls for an annual payment of $12 for each ordinary size family cooking stove—hotels, and extra large ranges, of course, costing somewhat more. I believe it is the intention to supply grates and heating stoves in private dwellings at the rate of $8 per annum, where the supply is kept up for the entire year. If the supply is wished for only during the fall, winter and early spring seasons (say eight months in the year), then the charge is fixed at $1 per month for the first stove or grate, and seventy-five cents per month for each additional one. These prices are no doubt subject to modification, as many of the inhabitants deem them decidedly too high. So strong has been the feeling about this that the disaffection has culminated in the organization of a rival company styled the Citizens' Natural Gas Company, which concern has purchased a site located on the same creek, but much nearer to the town—in fact, right on its border. The projectors of the new company are ready to commence boring, and there is little doubt but that the gas vein will be encountered, although probably at a lower depth than the one reached by the People's Company. This is about all the information of a general nature that I can convey to you at present on the subject. Respectfully,

Jno. C. Hastings.

[Should the permanency of flow of these natural gas wells become well established, it would seem as though great things may be expected of them in the future.]

An Electric Freak at Niblo's Garden.—Just as the curtain was going down at the close of the scene known as the "Flower Ballet," which forms one of the attractions in the "spectacular exhibition" at Niblo's, in New York city (on night of Oct. 2), one of the bouquets of crisp flowers, which are lighted up by three Edison lights the moment they are set on a wire across the stage, burst into flames. A ballet girl caught up the blazing bunch, carried it off the stage, and the danger was at an end. The curtain was immediately rung up for the next part, and the dance went on as merrily as though nothing had happened. The blaze was not perceived by any one in the audience. Fireman Dugan, who reported the occurrence to the Fire Commissioners next day, said that a globe covering one of the electric lamps had been accidentally smashed. Gas lights on the stage must, and very properly too, be thoroughly protected by wire screen coverings, but there seems to be no provision—legal provision—requiring any protection for electric lamps. No doubt, though, but that matter will soon receive attention.

Something from Mankato, Minn.—Messrs. O. C. McCurdy & Co., who recently erected a gas work at Mankato, Minn., report that the new company is "booming" to such an extent that the managers have three times more business on hand than they can attend to. Despite this fact the same firm propose to construct another new plant at some point in Kansas. Will Messrs. McCurdy be kind enough to send us on the name of township in which the works is to be prosecuted? Before leaving this topic it might be of interest to give some few particulars regarding the growth of Mankato. Mankato is situated at the confluence of the Minnesota and Blue Earth rivers, and its progress has been so marked that it is now numbered as the fifth most important city in the entire State. Its railway advantages are excellent, and two natural waterways come within its limits. The facilities for easy and safe transportation thus afforded have made it a prominent manufacturing center. It is said to have the finest quarries west of the Mississippi river, and already ships large quantities of stone throughout the west and northwest. Large flouring interests have already centered there, and its valuable deposits of clay are attracting the attention of workers in that specialty. Brick-making is already a vast industry within its borders, and the entire place teems with the spirit of enterprise and advance. The McCurdy's "builded better than they knew."

Reducing Price of Gas at Bergen Point, N. J.—Mr. C. J. R. Humphreys, Secretary of the American Gas Light Association, and also Secretary and Superintendent of the Bayonne and Greenville Gas Light Company, of Bergen Point, N. J., under date of September 3, issued the following notice to the gas consumers of his city:

"The Directors of this company have decided to make to private consumers what will in effect be a very material reduction in the price of gas. The reduction will be in the form of a discount, for cash payment, on the following basis. The bills will be made out, as heretofore, at $3 per thousand feet, but on bills paid by the 15th of each month a discount of 15 cents per thousand feet will be allowed on monthly bills of 2,400 feet or less; on bills from 2,500 to 4,900 feet a discount of 40 cents per thousand feet; on bills of 5,000 feet and over a discount of 60 cents per thousand feet. This makes the net price of gas, when bills are paid by 15th of each month:

For monthly bills of 2,400 feet and less....$2.85 per thousand.
" " from 2,500 to 4,900 feet.. 2.60 " "
" " of 5,000 feet and over. .. 2.40 " "

"To avoid any misunderstanding it is stated that the bills must be be paid by the 15th of the month to obtain the benefit of this reduction. On bills not paid within the specified time the full amount of $3 per thousand will be collected. There will be no variations from this rule. The foregoing schedule goes into effect on accounts to be rendered October 1st, and is to remain in force until further notice." To the energetic, determined and skillful efforts of Secretary Humphreys is in great measure to be attributed the success which has attended the rapid development of the business of the Bayonne Gas Light Company, and the last departure is sure to accelerate the ratio of its progress for the future.

Cheaper Gas for Plymouth, Mass.—Mr. Austin M. Copp, Treasurer of the Plymouth (Mass) Gas Light Company, writes that the directors of the corporation have determined to give the consumers a dividend in the shape of a reduction in the selling price of gas. On and after October 1st gas will be sold to the smallest class of consumers at the rate of $2.75 per thousand, the former price having been $3. The present send-out of the Plymouth Company is a trifle over three millions per annum, and Mr. Copp has been authorized to say to the residents of the place that if the annual make is increased by 10 per cent. during the ensuing year, the consumers will be entitled to another dividend at the end of the twelvemonth. How is that for fair play? A glance over the past history of the Company shows the selling price to have been (only seven years back, 1877) at the figure of $5 per thousand; further than this, not much "brag" could be made about the matter of candle power. It is not, then, to be wondered at that expenses were not even earned; but new management set about the task of straightening things out. The past fiscal year sees the stockholders paid a 6 per cent. dividend, and the consumers awarded 8½ per cent. of a reduction in the rate charged. What per cent. would the stockholders have received on their money if the 1883-4 schedule had been maintained at the prevailing figures of 1877? More than likely the stockholders would have been treated

to what the California miners facetiously term an "Irish dividend"—that is, a pro rata assessment to keep the sheriff out of the place.

CHEAP GAS FOR NASHUA, N. H.—On the first day of October the Nashua (N. H.) Gas Light Company reduced its selling price from the rate of $2 to $1.80 per thousand cubic feet. As this is Mayor A. M. Norton's Company (another favorite of the people, by the way), we will let the local daily paper of the place (the Nashua *Telegraph*) tell the story, which it does in the following manner:

"In 1876 the price was $3.80 per thousand feet, and since then reductions have been made from time to time until now the price is to be lower than in any other city of the size of Nashua in New England. It is interesting to note in this connection that the business tact and liberality of the managers of the Company, by which these reductions have been made, have proved advantageous to all concerned. It has caused an increase, since 1876, of 80 per cent. in the amount of gas consumed; and at the rate of increase now going on the consumption of 1876 will be more than doubled up at the end of 1886. The foresight of the Company in granting the reduced prices, thereby greatly increasing the send-out, enables it to earn sufficient profit wherewith to pay fair dividends, besides meeting the necessary expenditures for improvements. The Company has shown most certainly how to act with wisdom both as regards its own and the people's interests. The Company manufactures nothing else but coal gas, and those familiar with the question do not hesitate to say that it is as good an illuminating vehicle as that supplied in any other portion of the country."

No wonder Mr. Norton could be chosen Mayor of his city, if such is the way in which his business methods are upheld to public notice by the daily prints close at home.

COLUMBUS, GA., ALSO HEARD FROM.—Even the "Sunny South" joins in the movement of reduction, as witness this notification, for which we are indebted to Mr. E. H. Jenkins. Mr. Jenkins is Superintendent of the Columbus (Ga.) Gas Light Company, and toward the end of September he was authorized by his board of direction to inform the gas consumers that on and after October 1st a reduction of 10 per cent. from the old rates would be granted on all accounts settled on or before the 7th day of the month from date of rendering. The hitherto ruling charge has been $3 per thousand; consequently the announced reduction means gas at $2.70. The Columbus Company also furnishes us with another excellent illustration of the idea that cheap gas is bound to win. Ten years ago gas was sold in Columbus at the rate of $6 per thousand cubic feet, and now we find them willing to acknowledge that they make four times more money at the new rates than they did at the old ones. Of course the place has grown in wealth and prosperity; and it can be just as truthfully said that the public spirit possessed by those in control of the gas supply has been no mean factor in helping on that growth. In the course of a conversation held between Mr. Jenkins and a reporter attached to the Columbus *Enquirer*, the former gentleman said: "We only want more encouragement from the citizens of Columbus in the way of increased patronage to make still further reductions in our selling rates. You may not think so, but Montgomery has twice as many private consumers as Columbus, and Macon has three times as many. Suppose we had double our present patronage, could we not afford to sell gas at a still lower figure? Not only have we reduced our prices, but we have increased the candle power; and without fear of contradiction I can assert that we supply as good an article of gas as is manufactured anywhere in the State of Georgia. We have improved our plant by the addition of two new stacks of benches; have put in an entire new system of street mains, enabling us to give better satisfaction in the matter of pressure; services have been looked after, and everything has been done in the direction of making our plant thoroughly equal to whatever demands may be made upon it. You may rest assured that as our patronage increases to the point where it is rendered possible to make a still lower rate, such a step will be immediately taken." Well said, Mr. Jenkins.

TO USE GAS IN THE COOKING RANGES.—Nearly all those who have visited New York city will remember the famous restaurant known as the Mount St. Vincent Hotel, and located on a commanding height in Central Park, that was destroyed by fire some years ago. It was justly celebrated for its homelike appearance, and the excellence of its viands; and many of the roadmen who were wont to speed their horses on the adjacent boulevards have mourned the necessity that obliged them to pass it by. But the mourning will now give place to joy, since the ruin has at last been repaired, and the new hostelry has been already adjudged by the visitors as even superior to the one of former days. Mr. C. S. Conkling, who has secured the lease of the place from the Park Commissioners, has expended some $20,000 in decorating the restaurant, and the appointments are first class in every respect. But what will please the gas men most is the news that the kitchen ranges are to be heated by gaseous fuel. Mr. Conkling, who is an undoubted authority on the question, says that meats cooked by gas heat are far superior in flavor to those cooked over a coal fire, without mentioning anything in relation to the matter of cost—although he admits that factor to be also in favor of the gas man's product.

A NOVEL CONFLAGRATION.—An electric wire passing in front of the premises at No. 69 East Fourth street, New York city, kept rubbing against the limb of a dead tree until the insulator covering became worn through. On the morning of September 29th the limb caught fire and burned up with a blaze, to the great wonderment of a crowd of spectators.

STREET LIGHTING AT ROCHESTER, N. Y.—The Rochester (N. Y.) Common Council, at a former session, having failed to agree upon a satisfactory basis of lighting the city streets, appointed a committee of five citizens to act in connection with the Lamp Committee in the attempt to frame some sort of an arrangement whereby the lighting problem might be unraveled. This citizens committee (appointed by a resolution of Council, passed August 26) recently handed in its report, and from it we find that a recommendation is offered to the effect that the Brush Company be empowered to do the entire street lighting of the city. The offer of the Brush company was to furnish 800 or more electric lights at the price of $90 each per annum. Should a less number of lights than 800 be deemed requisite, then the price for each (down to 750) to be at the rate of 30 cents per night—materials, repairs, care, etc., to be included in the stated price. The committee seems to think that 750 electric lamps would prove sufficient. The document was ordered to be received, filed and published, final action on same being deferred for one week. The Rochester and Citizens' Gas Light Companies offered to maintain five feet burners in their gas lamps at an annual charge of $21.90 each, and this certainly seemed to be a fair and equitable price. The impression in Rochester at present is that the electric contract will be entered into. We are inclined to wish that it may be done, in order that the people may have a chance to see the foolishness of the move; and because it is almost impossible to conceive how the Brush folks can help but lose money at the game. We will ask Mr. Cartwright to advise us as to the final action of the Council.

WHERE WILL BROTHER HARBISON STOP?—At a meeting of the Directors of the Hartford (Conn.) Gas Light Company, held on Monday, Oct. 13, it was unanimously resolved that on and after Dec. 1st. next the price of gas would be reduced to $1.60 per thousand. Well, here's cheapness!

NEW YORK FIRECLAY GOODS MANUFACTURERS KEPT BUSY.—The past season has been an exceptionally busy one with the retort and fire-brick manufacturers operating in this vicinity. Adam Weber, of the Manhattan Retort Works, 15th street and Avenue C., New York city, reports that he is now finishing up the following orders: Twenty benches of sixes (through retorts) for Equitable Company, of New York city; sixteen benches of sixes for the Buffalo (N. Y.) Gas Light Company; and four benches of sixes for the Utica (N. Y.) Gas Light Company. The last named are to be fired under the Liegel regenerative furnace system.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Explosion and "Agitation."

NEW YORK CITY, Oct. 10, 1884.

To the Editor AMERICAN GAS LIGHT JOURNAL:

In your issue of October 2 is given an "item" concerning the explosion of an agitator at an oil works on Newtown Creek, Long Island. Reports of the explosion of agitators seem to follow one another very frequently, and all this in face of the assertions made by a celebrated professor, deeply versed in the theory of water gas, that agitators cannot, will not, and do not explode. Why the agitators should have the temerity to continue to explode when the learned professor before mentioned says "they cannot," is one of those things that our old friend, Sothern, used to say, "No fellah can find out."

Perhaps the explosion noted above took place in the Newtown Creek Gas Works, thus literally "knocking spots" out of the agitator. Such a thing was previously stated to have been the case by our water gas professor; and if so then, why not so now? The mere fact that there is no water gas works on Newtown Creek would have little bearing on the subject, as our learned professor, with the assistance of the head or tail of the Standard Oil monopoly, ought to be able to prove conclusively that, if there were no gas works in the particular vicinity, there should have been one, in order to enable them to properly carry out the theory put forward by them as fact in the instance mentioned.

Would it not be well, under these circumstances, to urge upon the attention of our authorities the advisability of the appointment of a "scientific commission," composed of men of unquestioned veracity, clothed with full power to make and determine the following inquiry, to wit: Under what circumstances and conditions of the atmosphere are gasholders most liable to blow up and destroy agitators; and, also, to report whether it would not be advisable to remove all gasholders from any close proximity to agitators, with the view of preventing the latter from being blown up by the former?

Yours, S. E.

THE AMERICAN GAS LIGHT JOURNAL

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THURSDAY, OCTOBER 16, 1884.

Foreign Pipe Lines.

The producers of petroleum on the western shore of the Caspian Sea have been contemplating seriously the laying of a pipe-line entirely across Persia to the Persian Gulf. If this were done they say that they would have the Asiatic market to themselves; which is not so certain, however, because there would be no traffic to the Persian Gulf port for vessels taking petroleum to India, China, etc., from it. A pipe-line would have to be something more than 700 miles long to reach the coast, and as it would for a long distance pass through a territory of savage Kurds and other nomadic tribes, it is feared that it could not easily be kept in operation.

Electric Lighting.

Among other things mentioned by the writer, in an article on the above named subject, which lately appeared in the New York *Times*, we find it asserted "that incandescent electric lighting, instead of being regarded as an experiment, and requiring temporary appliances, has shown itself entitled to be considered a permanent institution, and as such demanding appliances which can be depended on for common use. The same cause has brought about the exercise of more care in preventing leakage caused by inferior insulation, as well as the improvement of the lamps, which now go out much less frequently than they used to. Still there is much room for improvement in this matter. Although the average life of a lamp is longer than it was, the deterioration of the lamp in use is still much too rapid. And the cost of the lamps, to say nothing of the expense of the illumination, is still too great. In the arc systems of electric lighting much remains to be done in the way of improvement. The flickering of the light is not yet done away with, the hissing sound emitted by the lamps still remains a nuisance, and the dangerous conducting wires continue to encumber the streets, and add a dangerous element to the thoroughfares. The fixtures used in arc lighting are generally of crude construction, the connections with the mains are slovenly, the insulations prove defective in too many instances, and the general appearance of the structures is not creditable to the taste of the designers. The cost, also, remains too great. Despite these drawbacks the progress has been very noticeable. Practical electric lighting is a matter of only a few years' standing, and much has been done to improve it since its first public introduction. The strife of competition, the struggle for the largest possible share of public favor, and other economic considerations, not to mention the effect of wholesome laws such as that requiring electric light mains to be placed underground, will do much to further improvement. It will not be long before the makeshifts of the experimental period of electric lighting will be bygones."

Metalizing Wood.

According to *Van Nostrand's Magazine*, Rubennick's process for metalizing wood consists in steeping the wood in a caustic alkali for two or three days, according to its degree of permeability, at a temperature between 164° and 197° Fah. The wood is then placed in a second bath of hydrosulphate of calcium, to which is added, after twenty-four or thirty-eight hours, a concentrated solution of sulphur. After forty-eight hours the wood is immersed in a third bath of acetate of lead at a temperature between 95° and 122° Fah., where it remains from thirty to fifty hours. After a complete drying the wood thus treated is susceptible of a very fine polish, especially if its surface is rubbed with a piece of lead, tin or zinc, and finished with a burnisher of glass or porcelain. It then looks like a metallic mirror, and is completely sheltered from the deteriorating effects of moisture.

The Setting of Cement.

A noted German authority, Herr Frühling, recently published some interesting comparisons between the rate of hardening of hydraulic cements, and upon the nature of this process. According to this investigator, a Portland cement (which requires from twelve to fifteen hours to set) will inside of three days have acquired a greater hardness than the far more quick-setting Roman cement (which requires only from five to fifteen minutes to set). He makes the further assertion that, while the hardening process with the quick-setting Roman cement continues for many months, or even years, this process with a genuine Portland is substantially completed within the first fifteen days, for the amount of increase in hardness which takes place thereafter, he affirms, is quite insignificant in comparison with the figures representing the hardening of the first fifteen days. In this statement Frühling is not in accord with all writers on the subject, who are unanimous on the point that Portland cement continues notably in hardness and tenacity for the period of a year, or even considerably longer. He discards also the generally accepted explanation that the hardening of cement depends on the formation of silicates. He considers a hardened cement to possess, both chemically and physically, the properties of a dense hydrate of lime. He bases these statements on the following facts: The natural hydrated silicates of lime do not exercise any decomposing action on solutions of ammonium salts—the chloride or sulphate, for example—while, as a rule, the entire quantity of lime in a cement, whether it be derived from a Portland or a Roman cement, will act upon the above named ammonium salts precisely like hydrated lime to decompose them. He argues that in the production of a cement the rule should be followed not to endeavor to introduce the largest possible quantity of silicic acid, but the largest quantity of lime. If the proper limit is overstepped, so that, for instance, three or four per cent. more silicic acid is introduced than experience has shown to be sufficient, the result is not a better hardening cement, but, on the contrary, one that is almost worthless. The formation of a hydrate of lime, according to Frühling, is the basis of the binding quality of the cements; and in comparison with lime, he claims that silicic acid and alumina play a very subordinate *role*.

The Market for Gas Securities.

Of course the leading topic on the street is the consolidation matter, and there seems to be a pretty well defined impression that the certain accomplishment of the scheme is by no means well assured. One of the leading stockholders in an important member of the proposed confederation is rather outspoken in his views, and is pronouncedly against the scheme. While the Equitable Company does not figure in the preliminary arrangement, it is still barely possible that it might come into it at a later period; for although its charter forbids its joining with other companies proposing to charge over $1.75 per thousand, if we remember correctly, neither is there any portion of its charter which would prevent it from entering into a compact, like the one now under consideration, when the price of gas would be fixed at or below $1.75. At any rate, quotations for Equitable stock have not suffered very much depreciation, as the figure of 90 bid plainly shows. Harlem is rather weak at time of writing (Oct. 14), and there is considerable grumbling among its shareholders as to the valuation at which it is rated in the proposed consolidated capitalization.

Brooklyn shares are strong and higher, and the financial status over there appears perfectly serene. Calms are oftentimes delusive. Consolidated gas, of Baltimore (Md.), has boomed up on the announcement of the ending of the gas war—76¾ being bid. It now appears that the Consolidated people got the biggest share of the plum, and it is supposed that matters have been so fixed up that shares of the company will earn somewhere in the neighborhood of seven per cent. per annum. Jersey City (N. J.) shares are firm; Hartford (Conn.) gas is higher, at 128 bid. This Company, on Dec. 1st. next, reduces the selling price of gas to $1.60 per thousand, and stockholders, therefore, need have but little fear of the opposition gentry. News from other points presents nothing of interest. For quotations, see below.

Gas Stocks.

Quotations by Geo. W. Close. Broker and Dealer in Gas Stocks (with W. B. SCOTT & CO.,)

34 PINE STREET, NEW YORK CITY.

OCT. 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Central	$466,000	50	75	90
Equitable	2,000,000	100	90	93
Harlem	2,000,000	50	125	133
" Bonds	170,000		—	—
Manhattan	4,000,000	50	308	312
Metropolitan	2,500,000	100	250	—
" Bonds	658,000	—	107	110
Mutual	3,500,000	100	130	133
" Bonds	1,500,000	1000	104	106
Municipal	3,000,000	100	228	230
" Bonds	750,000		107	110
New York	4,000,000	100	164	167
Northern	125,000	50	—	80
" Scrip	108,000			

Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	137	140
Citizens	1,200,000	20	94	96
" S. F. Bonds	320,000	1000	106	110
Fulton Municipal	3,000,000	100	155	157
" Bonds	300,000		104	108
Peoples	1,000,000	10	85	87
" Bonds	290,000	—	105	110
" "	250,000	—	90	95
Metropolitan	1,000,000	100	95	98
Nassau	1,000,000	25	108	112
" Ctfs	700,000	1000	85	90
Williamsburgh	1,000,000	50	135	140
" Bonds	1,000,000	—	104	108
Richmond Co., S. I.	300,000	50	—	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	80	85
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	100	105
" " Bonds	124,000	—	105	110
Chicago Gas Co., Ills			150	155
Cincinnati G. & C. Co.			187	190
Consolidated, Balt.			76⅞	77
" Bonds			112	112½
Central, S. F., Cal.			—	62½
Capital, Sacramento, Cal.			—	58
Hartford, Conn	750,000	25	128	132
Jersey City	750,000	20	145	155
Laclede, St. Louis, Mo.	1,600,000	100	100	—
Louisville, Ky	1,500,000	50	—	105
Montreal, Canada	2,000,000	100	186	187
New Haven, Conn		25	166	170
Oakland, Cal			29	30
Peoples, Jersey City		—	—	75
" " Bonds			—	—
Paterson, N. J		25	96	99
Rochester, N. Y		50	75	80
Washington, D. C	2,000,000	20	185	190
Wilmington, Del		50	188	—
Yonkers		50	—	40
St. Louis, Missouri	600,000	50	—	575
San Francisco Gas Co.				
San Francisco, Cal.			51½	53½

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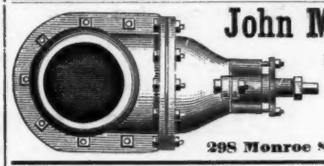

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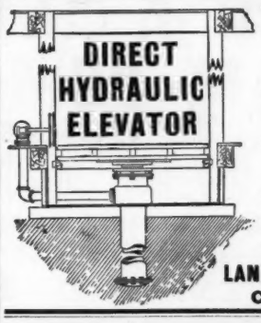

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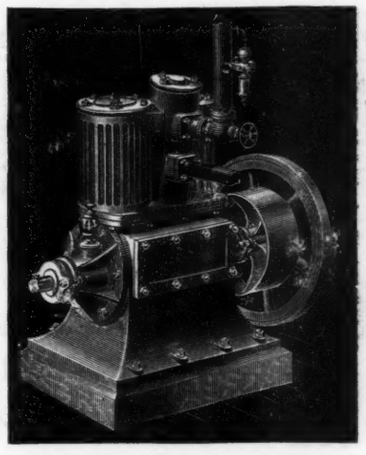

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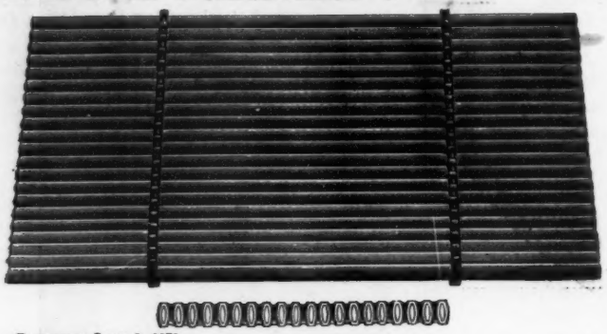

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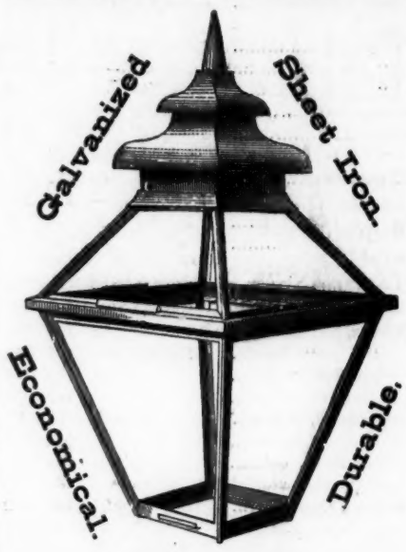

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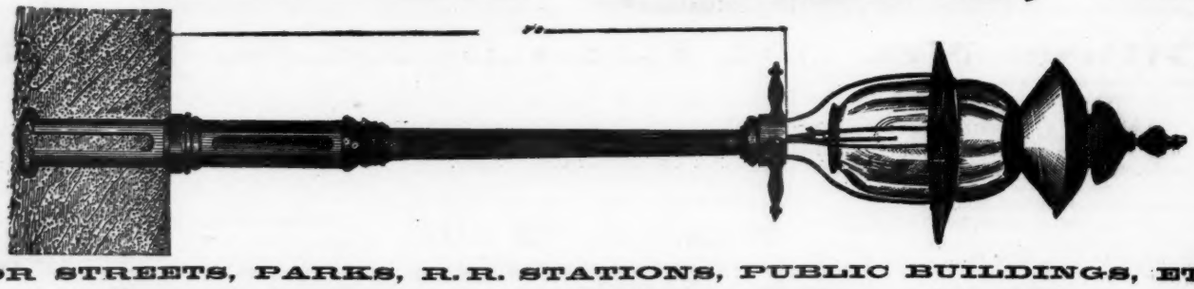

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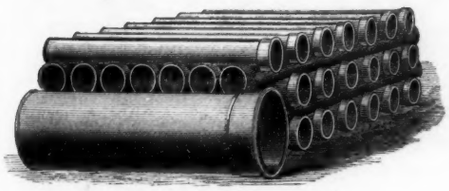

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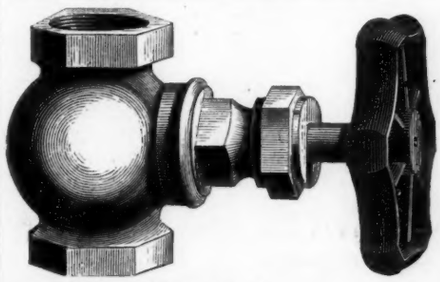

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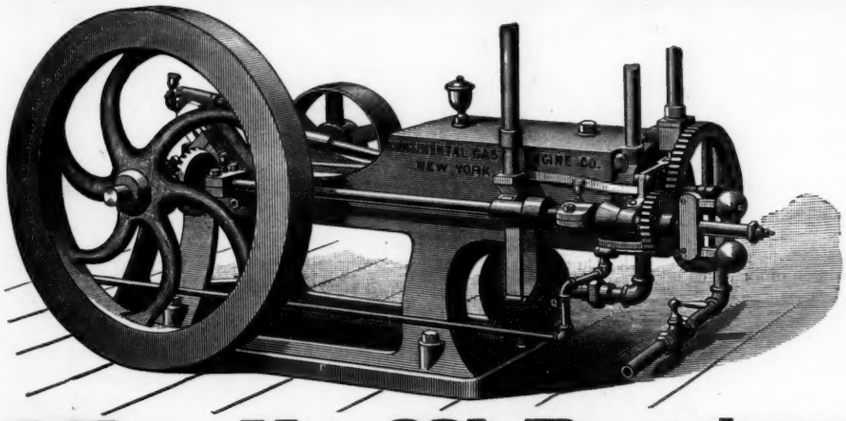

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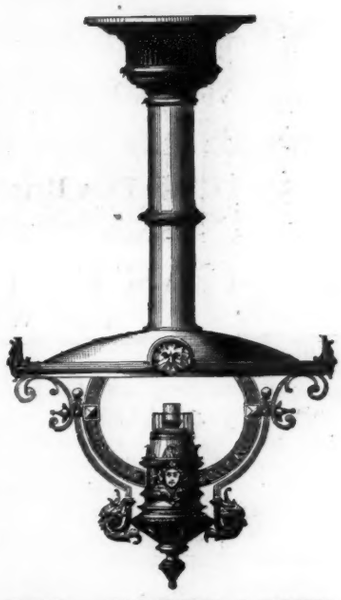

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1877	4,000,000	cubic feet.
1878	4,750,000	"
1879	24,545,000	"
1880	42,967,500	"
1881	36,462,500	"
1882	39,300,000	"
1883	57,735,000	"
1884	26,177,500	"
Total	235,937,500	cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	38	39,337,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,420,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	350,000
India	1	400,000
Total	248	235,937,500

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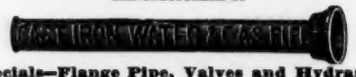

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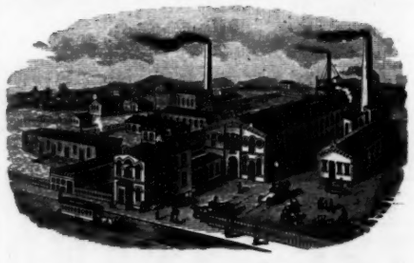

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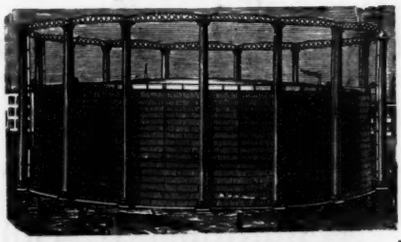

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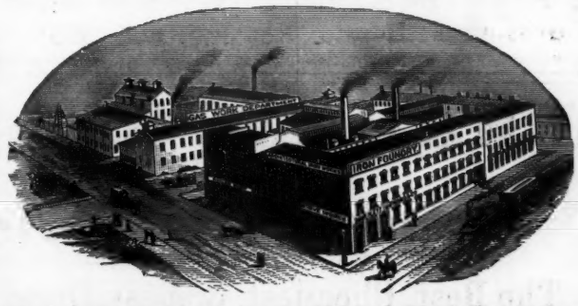

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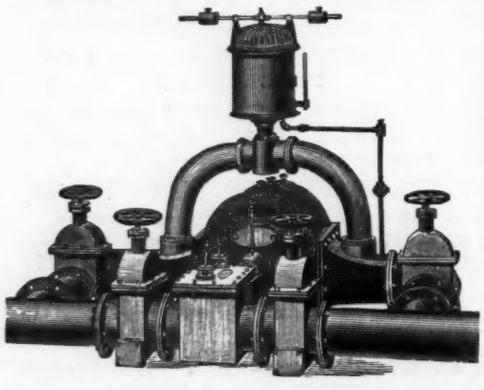

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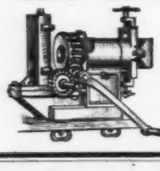

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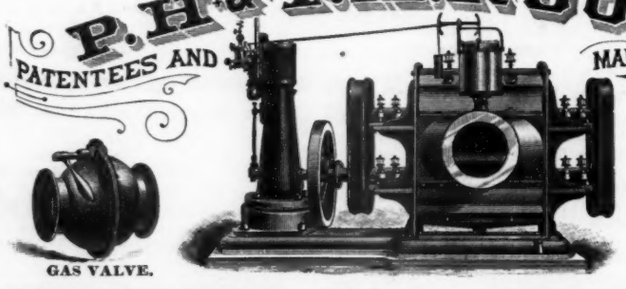

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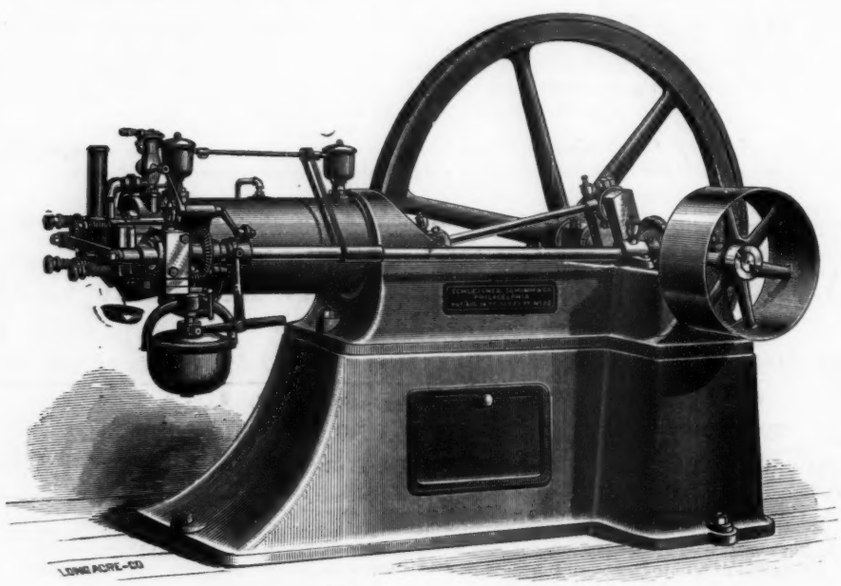

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